THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVIII. No. 1494.] LONDON, DECEMBER 29, 1891. [43RD YEAR. Price 6d.

GAS AND WATER PIPES.

1½ to 12 IN. BORE.

THOMAS ALLAN & SONS,

Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

GLASGOW OFFICE: 24, GEORGE SQUARE.
Telegrams:
"BONLEA, STOCKTON-ON-TEES."
"SPRINGBANK, GLASGOW."

— ESTABLISHED 1830. —

PARKER & LESTER,

Manufacturers & Contractors.

THE ONLY MAKERS OF

PATENT ANTIMONY PAINT,

Parker's Imperial Black Varnish,

Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.

WOLSTON'S

TORBAY PAINTS

Special Quotations to Gas Companies.

DARTMOUTH, DEVON.

CEMENT

EARLE'S

BEST

Portland Cement

MANUFACTURED BY

GEO. & THOS. EARLE,

HULL.

Offices: 7, 8, & 9, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.

ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY
Telegraphic Address: "CEMENT HULL."

PURIMACHOS GAS CEMENT

Capable of withstanding Greater Heat than that adequate to the Fusion of Iron.

Supplied to Her Majesty The Queen; to His Royal Highness The Prince of Wales; and to Her Majesty's Government; to Foreign Governments; and to public and private Gas-Works, &c., in GREAT BRITAIN and IRELAND, in ALL THE COLONIES, and in EVERY OTHER PART OF THE WORLD where Gas is used.

PURIMACHOS is regularly and increasingly used in GAS-WORKS at home and abroad, and has received the special commendation of the most distinguished Engineers and Managers, as invaluable for promptly and economically building, glazing, repairing, and consolidating RETORTS and FURNACES (in and out of action), PIPES, and ALL OTHER ERECTIONS (of Clay, Brick, or Iron) where FIRE or HEAT is employed—the action of which it will effectually resist.

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Registered Telegraphic Address: "PURIMACHOS, BRISTOL." | Prices and further particulars on application to **THE MANAGER, BRISTOL PURIMACHOS WORKS, REDLAND, BRISTOL.**

PATENT SULPHATE OF AMMONIA PLANT.

C. & W. WALKER.

PATENT MURIATE OF AMMONIA PLANT.
PATENT LIQUID AMMONIA PLANT.
PATENT TAR PLANT.

Makers of the most perfect form of Apparatus for the Manufacture of Sulphate, Muriate, Liquid Ammonia and Tar Products.

Apparatus already erected have proved more economical in consumption of Fuel, Simplicity, and Cheapness of Working than any known Plant.

Sole Makers of Claus' Patent

SULPHUR RECOVERY PLANT

for recovering Sulphur from Waste Gases containing Sulphuretted Hydrogen.

Testimonials & Estimates on Application.

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SAWER AND PURVES,

LATE

FLETCHER AND MURPHY,

GARRATT STREET WORKS, OLDHAM ROAD, MANCHESTER,

Manufacturers of

IMPROVED CONSUMERS' WET GAS-METERS

IN CAST-IRON CASES,

THE UNVARYING WATER-LINE GAS-METER,

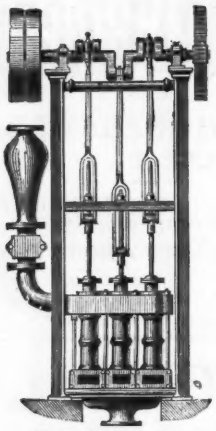
AND

IMPROVED DRY GAS-METERS.

SPECIALITY: PATENT CASH PREPAYMENT METERS.

STEAM & HAND PUMPS FOR GAS-WORKS,

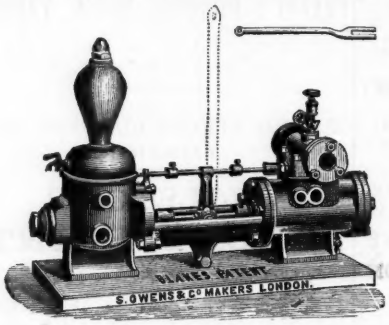
FOR PUMPING TAR, WATER, AND LIQUOR.



Treble-Barrel Pumps in Frame.

Syphon Pump.

Double-Barrel Force-Pump in Frame.



BLAKE'S
PATENT
STEAM PUMPS.
20,000 IN USE.

Improved Double Action Pump.

Cast-Iron Hand-Pump.

Wrought-Iron Portable Pump.

S. OWENS & CO., Hydraulic, Gas, & General Engineers, WHITEFRIARS ST., LONDON, E.C.

SOLE MANUFACTURERS OF

MANN & OWENS' PATENT SCREW & CAM, also FULL-WAY RACK & PINION GAS-VALVES.

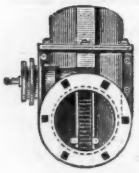
S. O. and Co.'s New Catalogue of Gas Apparatus and General Machinery can be had on application.

NEWTON, CHAMBERS, & CO., LIMITED

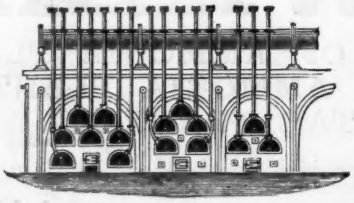
THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

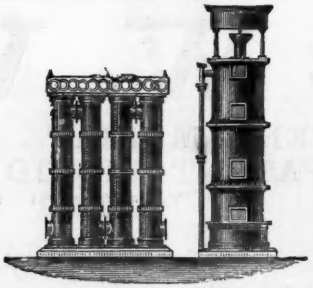
SLIDE VALVES,
WITH RACK & PINION,
OR
Internal or External
SCREWS, of all Sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description.
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.

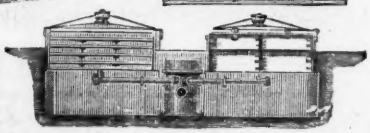


WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

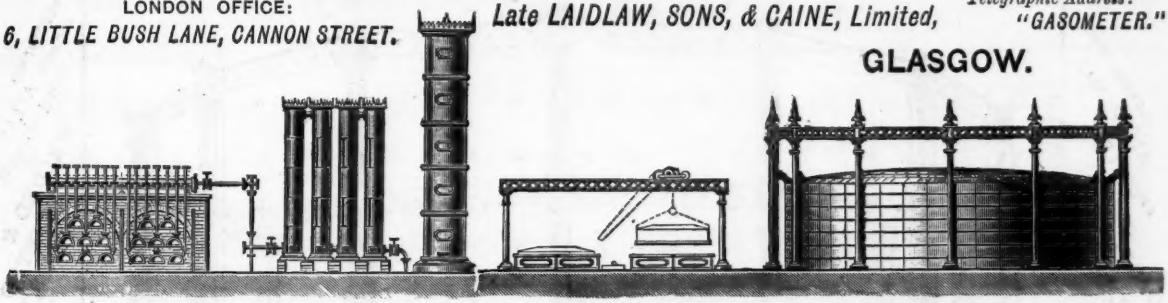
THE BARROWFIELD IRON-WORKS, LIMITED,

LONDON OFFICE:
6, LITTLE BUSH LANE, CANNON STREET.

Late LAIDLAW, SONS, & CAINE, Limited,

Telegraphic Address:
"GASOMETER."

GLASGOW.



MANUFACTURERS OF ALL KINDS OF GAS PLANT.

RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
CONDENSERS, EXHAUSTERS, AND ENGINES; SCRUBBERS, WASHERS;
PURIFIERS, WITH PLANED AND CEMENT JOINTS;
DRY AND HYDRAULIC CENTRE-VALVES;
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GASHOLDERS, SINGLE-LIFT & TELESCOPE; CAST & WROUGHT IRON TANKS;
STATION METERS; GOVERNORS; SCREW AND RACK VALVES;
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PROMENADE PIERS AND LOADING WHARVES.

MANUFACTURERS OF OIL PLANT OF EVERY DESCRIPTION.

HENDERSON'S Patent Retorts, Condensers, Stills, Cast and Wrought Iron Tanks, Ammonia Stills, Wrought-Iron Gas-Mains, &c., &c.

DESCRIPTIVE SPECIFICATIONS AND ESTIMATES ON APPLICATION.

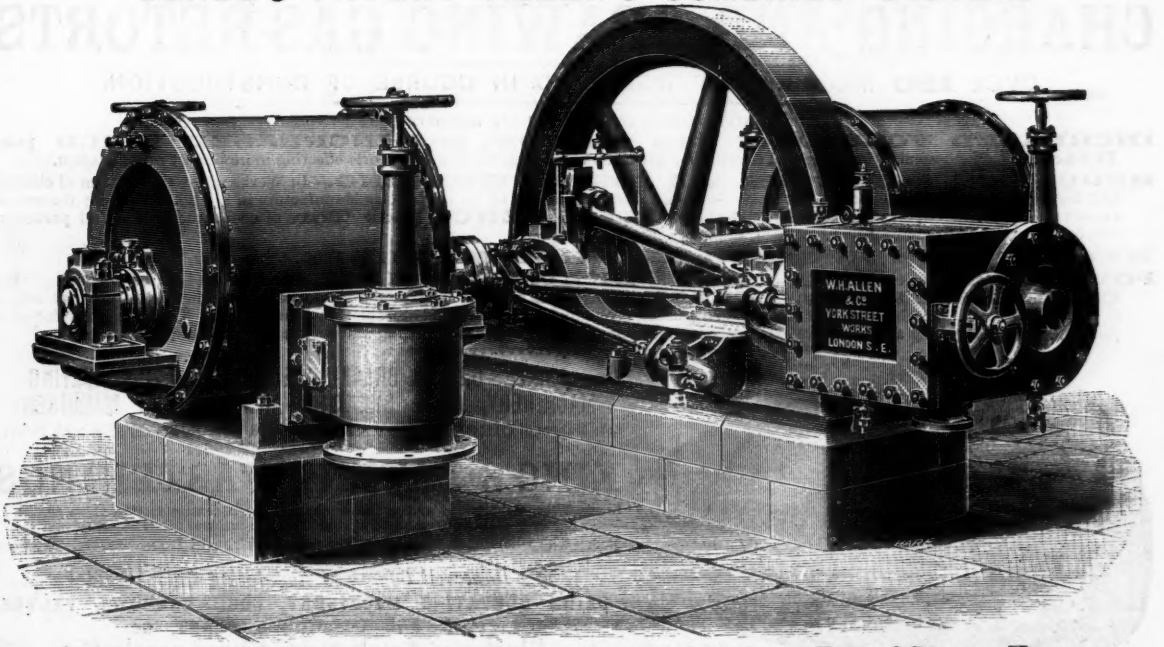
W. H. ALLEN & CO.,

York Street Works, LAMBETH, LONDON, S.E.,

MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

BEALE'S PATENT—ALLEN'S COMBINED SYSTEM.

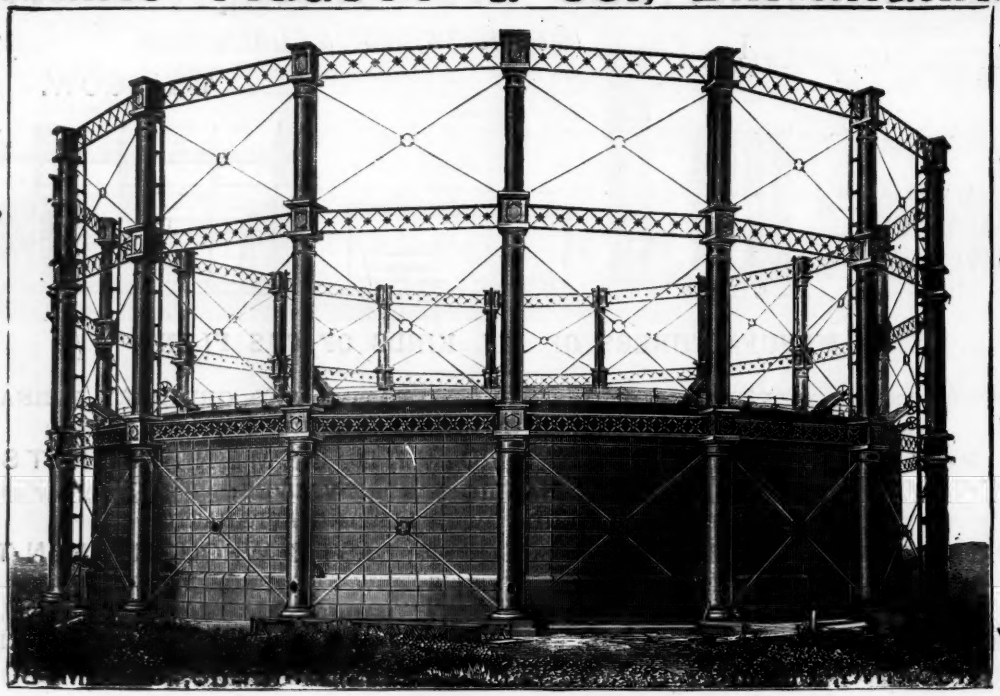


Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

THOMAS PIGGOTT & CO., BIRMINGHAM.

LONDON OFFICE: 57, ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED PIPES, MAINS, RETORT LIDS, WROT & CAST TANKS, PURIFIERS.

OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

BATH.	BOLTON.	BRISTOL.	CHELTENHAM.	LEAMINGTON.	PRESTON.	SHEFFIELD.
BELFAST.	BOMBAY.	BRISBANE.	HARTLEPOOL.	LIVERPOOL.	READING.	STOCKHOLM.
BECKTON.	BRADFORD.	CARDIFF.	LEEDS.	NOTTINGHAM.	RIO GRANDE.	SYDNEY.
BIRMINGHAM.	BRIGHTON.	COVENTRY.	LEICESTER.	OLDHAM.	SOUTH METRON.	VIENNA.

WEST'S GAS IMPROVEMENT Co., Ltd.,

Engineers, Ironfounders, & Contractors,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,

MANUFACTURERS OF

WEST'S PATENTED MACHINERY

FOR

CHARGING AND DRAWING GAS-RETORTS.

OVER **180** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

Advantages attending its use are:

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by COMPRESSED AIR, STEAM, or ROPE. The power machines are applicable to circular, oval, or Ω-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.

MAKERS OF COAL BREAKING, ELEVATING, AND CONVEYING MACHINERY, COKE BREAKING AND WASHING MACHINERY.

Sole Makers of **CIRCULAR, OVAL,** or Ω-shaped **MOUTHPIECES** with Morton's Self-Sealing Lids, fitted with

KING'S PATENT FASTENINGS,

secure a very tight joint; and at the same time the eccentric motion given to the Lid effectually removes the Tar from the surfaces of the Joint.

N.B.—The whole of these Fittings are made of Wrought Iron. Several Thousands in use.

West's Improved Combined Regulating Liquor Seal Valve.

OXIDE ELEVATING MACHINERY, COKE BARROWS, VALVES, AND ALL GAS-WORKS PLANT, &c.

Illustrated Catalogue sent upon application.

Mr. JOHN WEST, M. Inst. C.E., *Managing Director.*

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S PATENTS

All Spent Limes are most effectually, economically, and continuously recovered, and at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it. Descriptive Pamphlet and Terms from Agents as under.

— REGENERATIVE SETTINGS OF RETORTS. —

Hislop's Patent Producer and Patent Charging Appliances offer advantages which are unapproachable, while in every other detail his Settings are confidently recommended as being the most inexpensive and effective possible.

Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

Abercorn Foundry and Abbey Works,

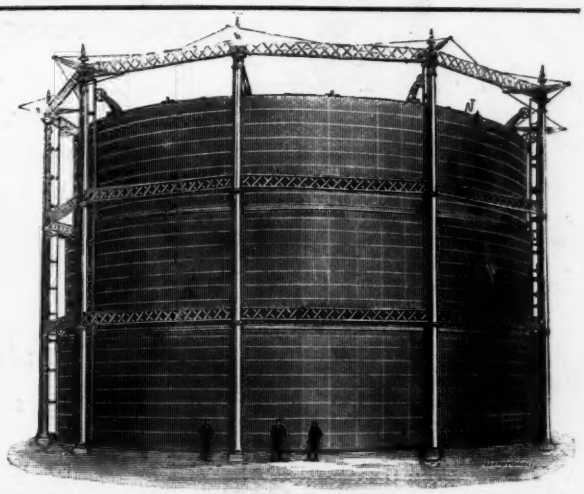
PAISLEY, N.B.,

MAKERS OF

Gasholders and Gas Plant

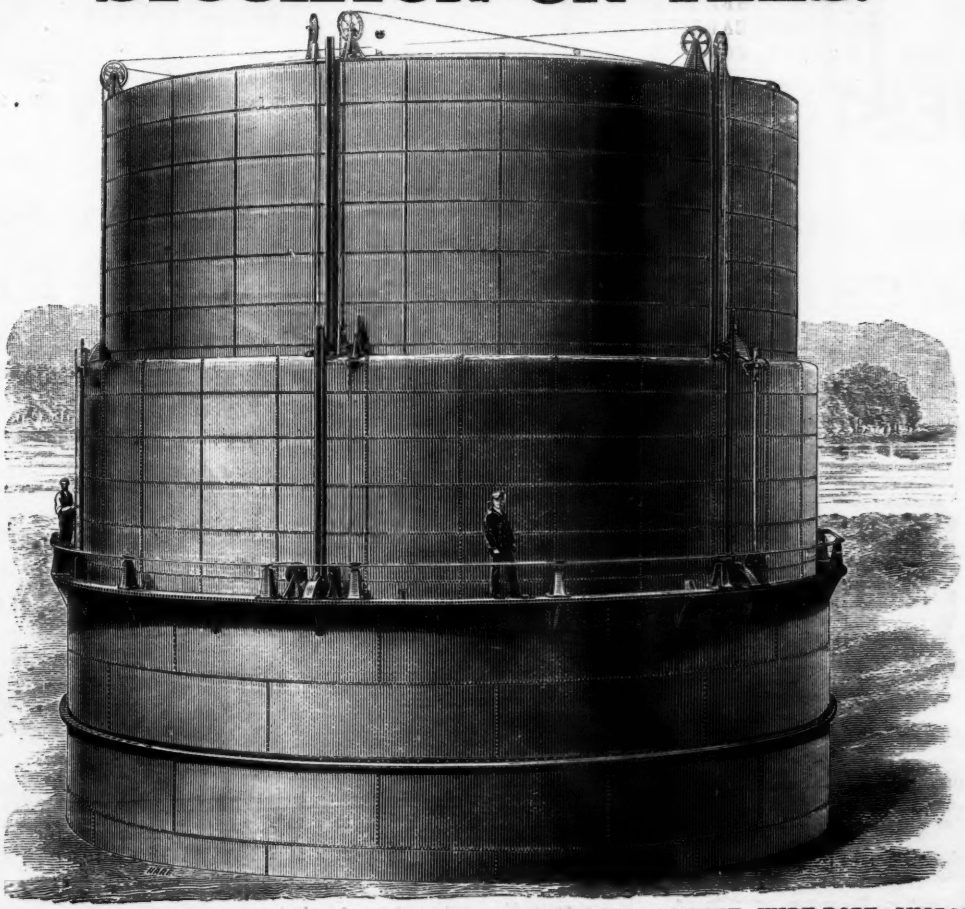
OF EVERY DESCRIPTION.

Telegraphic Address: "Donald Paisley."



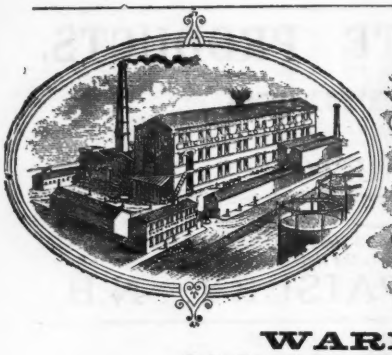
ASHMORE, BENSON, PEASE, & CO., LTD.,

STOCKTON-ON-TEES.



TWO-LIFT GASHOLDER, WITH TANK, WORKING WITH PEASE'S PATENT WIRE-ROPE SUPPORTS.

(From Photograph.)



GAS COOKING RANGES

Richmond & Co. Limited.

GAS FIRES
Heating Stoves
WATER HEATERS
BOILING BURNERS

GAS ENGINEERS

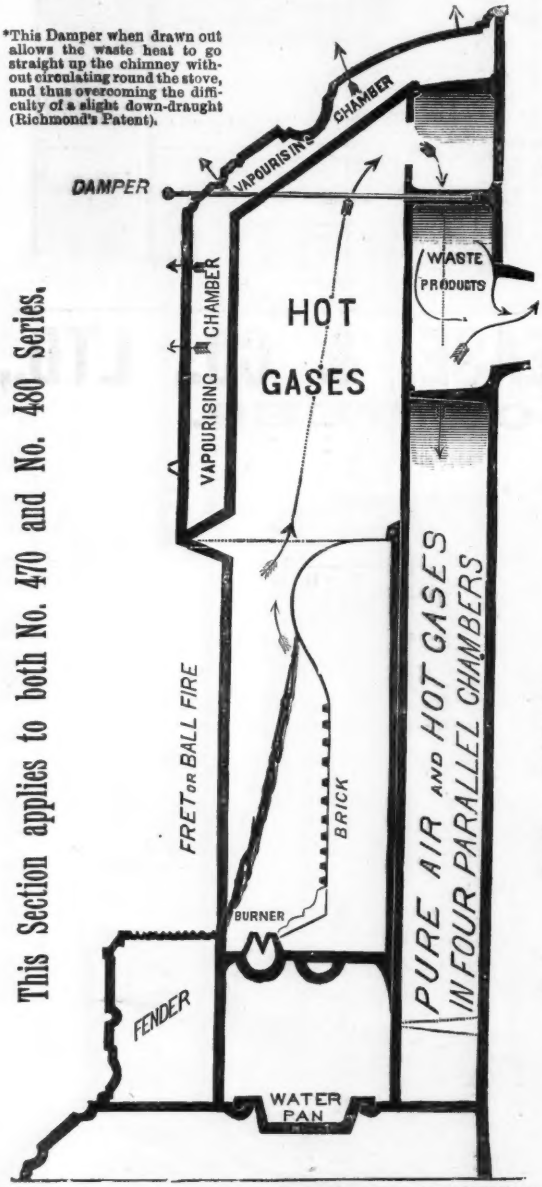
WARRINGTON & LONDON.*

Sole Agents for Webb's Lamps.

Telegrams, "Gastoves," Warrington.

E. W. T. Richmond, Managing Director.

*This Damper when drawn out allows the waste heat to go straight up the chimney without circulating round the stove, and thus overcooming the difficulty of a slight down-draught (Richmond's Patent).



This Section applies to both No. 470 and No. 480 Series.

In these Stoves we have combined—

1. Chaste and Elegant design. The Ornaments are relieved artistically with Gold, and Figures Bronzed.
2. Most Perfect Patent Waste-Heat Arrangement yet invented. See section.
3. A combined Water Pan and Fender, from which vapour is delivered along with the pure heated Air into the apartment.

The advantages of the two last-mentioned features cannot be over-estimated. We are sure this Fire only needs to be seen to be purchased.

Filled with Double Corrugated Iron Fret or Ball Fuel at same price.

WE CAN NOW DELIVER ON RECEIPT OF ORDER.

The "VICTOR." No. 470 Series.

The "SUPERB." No. 480 Series.

	With Stand. High. In.	Wide. In.	Deep. In.	Stove Enamel Gold Relieved. Figures Bronzed.	Best Victoria Bronze, with Stand, Water-Pan, and Damper.
470 Fret 1470 Ball	30	19½	7½	£2 5s.	£5 13s.
472 Fret 1472 Ball	31½	21½	9	£2 15s.	£6 13s.

	With Stand. High. In.	Wide. In.	Deep. In.	Stove Enamel Gold Relieved. Figures Bronzed.	Best Victoria Bronze, with Stand, Water-Pan, and Damper.
480 Fret 1480 Ball	30	22	9	£2 15s.	£6 3s.
482 Fret 1482 Ball	31	24	10	£3 5s.	£7 3s.

Make Stove very complete. Stand and Water-Pan, extra 8s. 6d. Richmond's Patent Damper, extra 4s. 6d.

Sizes, 470, 1470, 480, 1480: 22 in. × 12 in. × 2 in. high.

472, 1472, 482, 1482: 24 in. × 13 in. × 2 in. high.

* Temporary London Offices and Show-Rooms, 65 & 66, Basinghall St., E.C. Mr. J. F. Simmance (for 17 years with W. Sugg & Co., Ltd.), Branch Manager.

TANGYES LIMITED

CORNWALL WORKS, BIRMINGHAM.

LONDON: 35, Queen Victoria Street, E.C.
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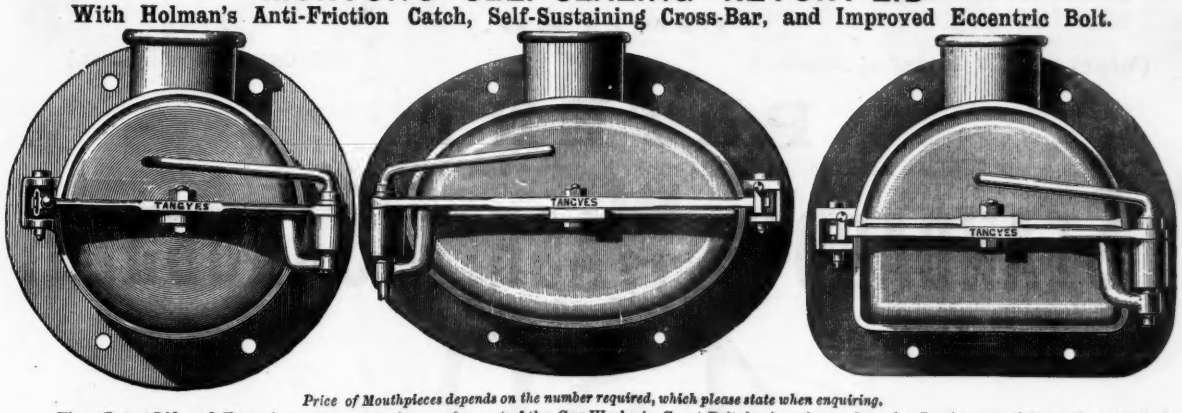
MORTON'S SELF-SEALING RETORT-LID

With Holman's Anti-Friction Catch, Self-Sustaining Cross-Bar, and Improved Eccentric Bolt.



Price of Mouthpieces depends on the number required, which please state when enquiring.

These Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, round, oval, and D (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
3494	14 ins.	14 ins.	12½ ins.	£0 19 0
2982	15 ,,	15 ,,	14 ,,	1 0 0
3453	15 ,,	15 ,,	12½ ,,	1 0 0
3497	15 ,,	15 ,,	15 ,,	1 0 0
3630	16 ,,	16 ,,	10½ or 11⅝ ,,	1 1 0
4549	16 ,,	16 ,,	15½ ,,	1 1 0
6262	16 ,,	16 ,,	13½ ,,	1 1 0
6396	16 ,,	16 ,,	15 ,,	1 1 0
7668	16 ,,	16 ,,	17⅝ ,,	1 1 0
10289	16 ,,	16 ,,	11 ,,	1 1 0
3356	17 ,,	17 ,,	15 ,,	1 3 0
7125	17 ,,	17 ,,	6 ,,	1 3 0
933	18 ,,	18 ,,	11⅝ ,,	1 5 0
4045	18 ,,	18 ,,	14 ,,	1 5 0
6397	18 ,,	18 ,,	15 ,,	1 5 0
8013	18 ,,	18 ,,	15 ,,	1 5 0

Taper Circular Mouthpieces with Circular Lids for Round Retorts.

Pattern No.	Front. Back.			
13001	15 to 21 ins.	21 ins. diam.	13½ ins.	£1 0 0
13261	15 ,, 24 ,,	15 ,,	13½ ,,	1 0 0
12995	15 ,, 30 ,,	30 ,,	13 ,,	1 0 0
9562	18 ,, 21 ,,	21 ,,	12½ ,,	1 5 0
10425	18 ,, 21 ,,	21 ,,	4½ ,,	1 5 0
13418	18 ,, 22 ,,	22 ,,	12 ,,	1 5 0
13396	20 ,, 20⅝ ,,	20⅝ ,,	4 ,,	1 11 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
14209	14 ,,	14 ,, 13 ,,	13½ ,,	0 19 0
14231	14 ,,	12⅝ ,, 12⅝ ,,	10 ,,	0 19 0
3463	15 ,,	15 ,, 13 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15½ ,,	15½ ,, 13 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 13 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12½ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
4434	16 ,,	17⅝ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	18½ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ or 19 ,,	1 1 0
8049A	16 ,,	18 ,, 15 ,,	17⅝ ,,	1 1 0
6137	16 ,,	20½ ,, 13½ ,,	13½ ,,	1 1 0
5918	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19⅝ ,, 12 ,,	14⅝ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15½ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7975	17 ,,	21 ,, 15 ,,	14½ ,,	1 3 0
13459	17 ,,	21½ ,, 13½ ,,	15 ,,	1 3 0
14284	18 ,,	18 ,, 13½ ,,	19 ,,	1 5 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18⅝ ,, 15 ,,	13 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	12⅝ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6475	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17½ ,,	1 5 0
13998	18 ,,	20 ,, 14 ,,	19½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	13½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19½ ,,	1 5 0
7356	18 ,,	20½ ,, 13½ ,,	13 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
13999	18 ,,	22 ,, 14 ,,	19½ ,,	1 5 0
7640	18 ,,	22 ,, 12¼ ,,	18½ ,,	1 5 0
14250	19 ,,	19 ,, 14 ,,	19 ,,	1 8 6
14286	19 ,,	20 ,, 13½ ,,	20 ,,	1 8 6
7971A	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0
14285	20 ,,	21 ,, 13½ ,,	19 ,,	1 11 0

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	12⅜ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18½ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15⅜ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	13½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	13½ or 15 ,,	1 5 0
3554	18 ,,	21 ,, 15 ,,	14⅜ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048A	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
9800	18 × 14⅞ ins.	18 × 14⅞ ins.	15 ins.	£1 5 0
9205	20 ,, 12 ,,	24 ,, 14 ,,	10½ ,,	1 10 0
10000	20½ ,, 14½ ,,	20½ ,, 14½ ,,	16 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15⅜ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	22½ ,, 13⅜ ,,	22½ ,, 13⅜ ,,	18⅜ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15½ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	16 ,,	1 18 0
13884	24 ,, 15 ,,	24 ,, 15 ,,	10 ,,	1 18 0

Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimension of Retort.	Length of Mouthpiece.	Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	12 ins.	£1 2 0
9967	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16⅜ ,, 13⅜ ,,	16⅜ ,, 13⅜ ,,	12½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
12980	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13⅜ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 13½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13½ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11096	18 ,, 14 ,,	18 ,, 14 ,,	12 ,,	1 6 0
9492	20 ,, 13 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15½ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13½ ,,	1 10 0
9909	20 ,, 13⅜ ,,	20 ,, 13⅜ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
14287	20½ ,, 14⅞ ,,	20½ ,, 14⅞ ,,	17 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
13992	21 ,, 16 ,,	21 ,, 16 ,,	17 ,,	1 11 0
8977	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
8976	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
10497	21½ ,, 13½ ,,	21 ,, 13½ ,,	18½ ,,	1 12 0
8037	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	18⅜ ,,	1 12 0
9908	21½ ,, 13⅜ ,,	21½ ,, 13⅜ ,,	15 ,,	1 12 0
10404	21½ ,, 13½ ,,	22 ,, 14 ,,	18½ ,,	1 12 0
12410	21½ ,, 13⅜ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13⅜ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 12⅜ ,,	22½ ,, 13⅜ ,,	13½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	15⅜ ,,	1 13 0
13807	24 ,, 15¼ ,,	24 ,, 15¼ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	19½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	13½ ,,	1 15 0
12944B	23 ,, 16 ,,	23 ,, 16 ,,	16 ,,	1 15 0
14037	22 ,, 16 ,,	2 ,, 16 ,,	16 ,,	1 15 0
14119	22 ,, 16 ,,	22 ,, 16 ,,	18 ,,	1 15 0

Patterns marked A have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.

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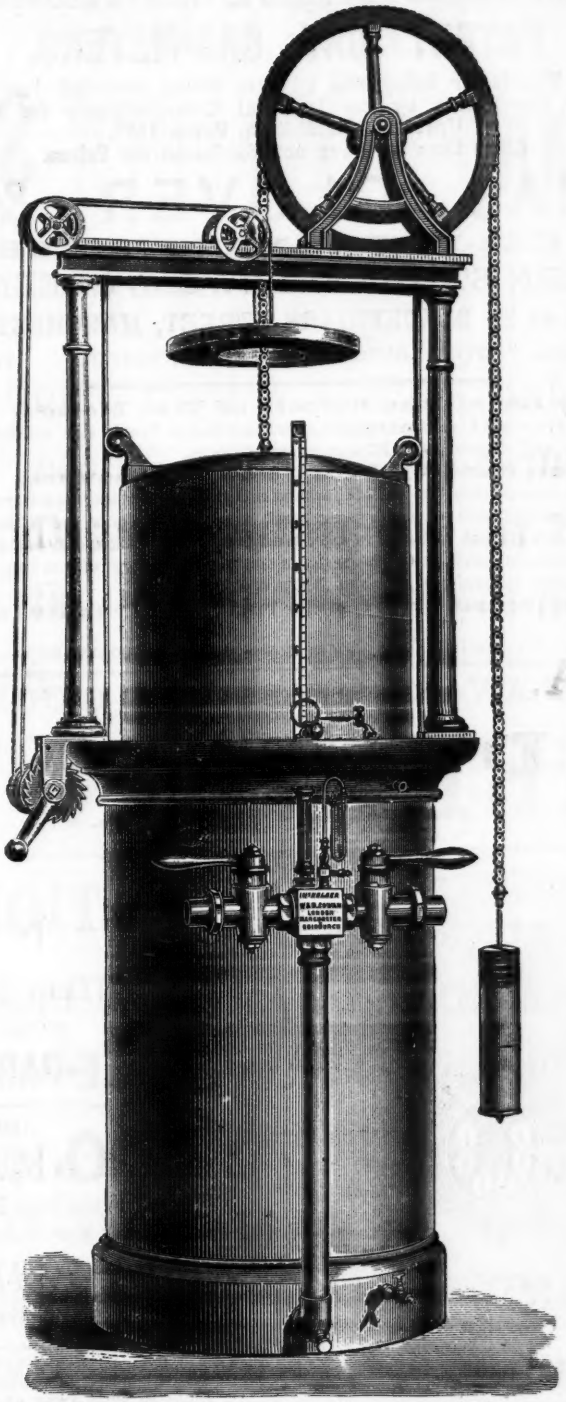

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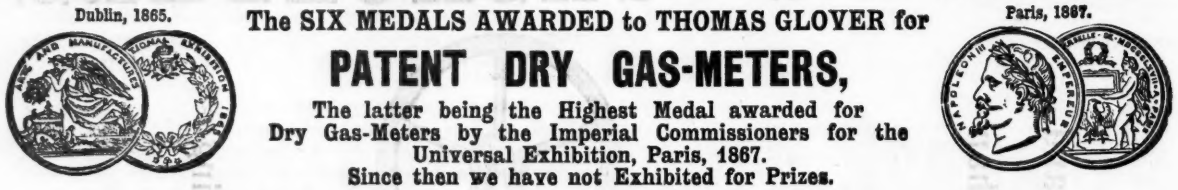

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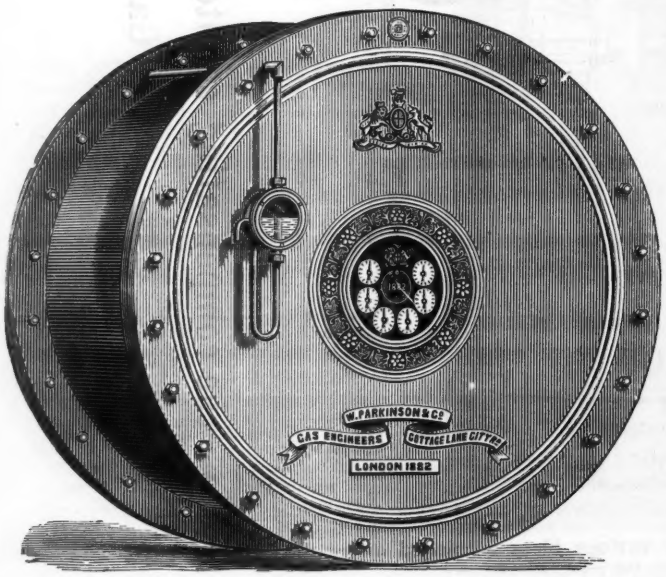

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, DECEMBER 29, 1891.

1891.

A Retrospect of the Year.

WHEN a chronicler sets himself to write down in condensed form a comprehensive review of the events, movements, and tendencies of a particular department of a nation's industry during such a period as a year, he is confronted with the reflection that the time over which his purview must range is both long and short. It is so long, that the effort to project the mind backwards along the stream of eventuality and tendency is no small tax upon the imaginative faculty. It is also so short, that, while it is comparatively easy to run over the actual incidents and occurrences that will bear its date in history, it is difficult to assign in their order of importance the suggestions and developments to which such a period may have given birth. As with individuals, so with special industries and with communities, after they have passed their youth and entered upon their inheritance, or taken their place in the world, year succeeds year without appearing to change them greatly in the eyes of contemporary observers. It is therefore only by glancing backwards over a considerable lapse of time that it is possible to see how far, and in what directions, movements which were almost insensible in their action have really carried the persons or things affected by them. It is with a view to this truth, the force of which we must all confess, that we have advocated in the pages of the JOURNAL the adoption, by those interested in following the fortunes of the gas industry, of some such means of marking from time to time the actual condition of this industry as is afforded, but imperfectly, and at disproportionate cost, by the holding of a succession of exhibitions. For the present, however, we have not to deal with any such matter. It would be impossible year by year to describe in these columns the whole condition of such a vast affair as the gas supply of the United Kingdom. The utmost that can be done is to mark the salient points of a year's doings, while much that might be stated by way of reasoning upon, or in criticism of these matters, must be either merely suggested or be left unsaid.

The year 1891 may be fairly described as belonging to an era of general national prosperity. Some observers may challenge the accuracy of this classification; but if we are to judge of the business of the country by that aspect which it ordinarily presents to those who are engaged in gas supply, it must be adjudged to have been, on the whole, good—more especially in the earlier half of the year. Last winter was one of exceptional severity; but there was nowhere any remarkable distress among the population that lives by industrial pursuits. Gas undertakings never experienced such a strain upon their manufacturing capacities as during the winter of 1890-91; and everywhere they had to report such increases of their output as compelled them to devote last summer to enlarging their productive plant. Coal meanwhile ruled high, and labour was dear; so that while the increased volume of trade done did not always return as much profit as might have been obtained under easier conditions, the facts indicated that the country was full of business. In one very important respect, however, business was dull—we allude to the condition of the world of finance, and its *demi-monde* of joint-stock speculation. Writing at this time last year, we were able to remark truthfully of the preceding twelve months, that speculation had been rife; but the Baring incident had checked investment. During the whole of the year, the discouragement remained; and the tribes of "promoters" have consequently experienced a wofully dull time, to which effect the revelations arising from such affairs as the Bottomley bankruptcy have also largely contributed. The speculative side of finance was, in familiar phrase, "all to pieces" during the whole of the year; and rarely have the summer holidays of "City men" been commenced so early in the season, or protracted so late into the autumn.

Meanwhile, those who regard the industrial affairs of the nation from the one point of view of the wage-earner, have been doing their best to hamper business by causing strikes in almost every trade and all over the country, and by clamouring for a law to render it felony for any workman to labour at his occupation, whatever it may be, for more than eight hours a day. Our columns have been full of records of the arrogance of Trade Union leaders and professional agitators who have striven to demonstrate that, in matters of wages and hours of work, it is only a question of "asking and having" from the workman's standpoint. It would serve no useful purpose to recapitulate the incidents in the so-called War of Labour against Capital, which was recognized, to a certain extent, by the appointment of a Royal Commission to inquire into the relations of employers and employed. This Commission, of which Mr. George Livesey, the Chairman of the South Metropolitan Gas Company, is a member, has already taken much evidence upon both sides, but has not yet opened the case of the gas workers, which is understood to be a very important portion of the general question. During the last year or two, the pay of all gas workers has

been very largely increased; and as there is no record of wages in this employment falling with bad times, the labourers in the operation of gas making will have cause to think themselves lucky if, as appears probable, the comparatively fat years, of which 1891 was one, should be followed by a greater number of lean ones.

For the fact is patent that business generally has been failing ever since last summer; the cold and wet season being responsible for much of the staple industry of the country being carried on at a loss. The price of coal has fallen steadily; although many gas undertakings, either by bad fortune or bad management, or a combination of both, had to buy their supplies at rates which, taken in conjunction with the rise in wages, necessitated increased prices for gas in different parts of the kingdom. Coke, however, has been accumulating on hand for months; partly owing to a mild autumn, and partly to the lack of activity among cement makers and other manufacturers requiring this kind of fuel for trade purposes. This, again, is a bad sign for the future of general trade. Moreover, the value of gas-works residuals has dropped seriously. It is reported also that the great engineering industries of the country, such as shipbuilding and the iron trade, are manifesting much irregularity in their different centres; some localities being fairly busy, while others are quiet or declining. When affairs are in this condition, it is very much more likely for the depression to spread than the prosperity. It is true that the chemical trade, with the exception of the gas-works residuals and tar products branches, is reported to be in a fairly sound position; but this is poor solace to those who are interested in the depressed branches. Looking all round, there is a good deal to be said for the prophets of evil days, who even now declare it to be their opinion that the country is on the verge of a period of stagnation and disaster in commerce and industry which has hardly been paralleled in recent history; and that, so far from workers of all classes being able to secure the realization of the New Trade Unionist ideal of "An Eight-Hour Day with Ten "Hours' Pay," most of them will be well off if they get work to occupy their full time. Let us hope that the darkest aspect of the situation will not prove to be the true one; but he is no friend to the working man, be he Trade Union organizer or Party politician on the look-out for the Labour Vote, who fails to remind the labourer that, even if Parliament could be prevailed upon to enact the punishment of penal servitude for whoever should be found to work longer than the mystic eight hours daily, there is no power on earth that can make a man of business carry on a losing trade against his will.

The condition of the Metropolitan Gas Supply has attracted much attention during the year. The acquisition of the Companies' undertakings for prices "fair to the "ratepayers," has been introduced as a "plank" in the "platform" of the self-styled Progressive Party in the London County Council; but since this platform also contains a large and varied collection of other "planks," reported to be of even greater importance to the stumporators who have arranged it as a support for themselves, there is no immediate need for more than bare mention of it as an incident of contemporary Metropolitan gas polity. The most interesting feature of the Metropolitan Gas Supply during the year was the struggle of the three Administrations with the difficulties created by dear coal and cannel, costly and in some instances insubordinate labour, gas testing, and assessment. In these, as in most other respects, the peculiar interest of London gas affairs consists in the extent to which the latter represent, upon the largest scale and in exaggerated proportions, the circumstances of all the gas undertakings of the country, taken singly or together. It is sometimes urged that it is a mistake to pay much attention to the gas affairs of London, because the circumstances of the Metropolitan Companies differ so markedly from those of all others in the world; and they only number three, all told. But, it may be asked, where is the gas manager, at home or abroad, who does not cherish the memory of an inspection of a large London works, or the hope of making one, as a precious aid in his technical training? It is not that a London gas-works is so much better appointed or better managed than many a country establishment of the kind. Indeed, the London engineer will be the first to tell his visitors of places where they may expect to see something very much finer than he can show them. But the essence of the interest in the doings and experiences of a London Gas Company is in the fact that the undertaking is exposed in the highest degree, and in the first line, to all the vicissitudes that overtake in turn all other gas undertakings in the kingdom. Whether it is a coal-masters' "ring" or a stokers' combination, it is London that feels the strain first, and in its worst shape; and the mistakes or the successes of London sooner or later teach the rest of the country what to do or to avoid. Last year the London Companies had a trying time; and the largest suffered worst. The fact that The Gaslight and Coke Company, who this time last year were selling gas at 2s. 9d. per 1000 cubic feet, have now again put up their price to 3s. 1d., is one of the most startling evidences imaginable of the stress to which the concern has been subjected in the effort to make both ends meet. The South Metropolitan Company had to raise their rate from 2s. 3d. to 2s. 6d.; and only to the Commercial Company remains the distinction of maintaining their low selling price, although, like their neighbours, they could not help dipping into their reserve. The comment of the public upon these vicissitudes of the London gas industry consists in a depreciated quotation of The Gaslight and Coke Company's "A" stock from 240, at which it began the year, to 222 or less.

It would be an exaggeration to say that the position of the London Gas Companies is worse now than it was a year ago, because the cloud is lifting as regards coal prices; but the labour difficulty still presses heavily upon the undertakings which did not purchase their deliverance at "great price," like the South Metropolitan Company. A marked feature of the year's doings in the London gas-works was the extensive use of petroleum oils and spirits for purposes of enrichment, in substitution for cannel; and this consideration suggests mention of the subject of gas testing, which is carried, under the Metropolitan Gas Referees, to a pitch of administrative perfection unequalled elsewhere. The disputes respecting the accuracy of the returns for deficiency of illuminating power against the Companies, which have grown so frequent during the last two or three years, came at length to a head; and the matter was put in a fair way of settlement by the action of the Board of Trade in appointing a Technical Commission to inquire once more into the question of the standard of light, with a view to recommending a substitute for the statutory candle, and an acceptable form of standard photometer. Upon the remaining topic of salient interest in connection with the affairs of the London Gas Companies—the new assessment—it is impossible to say much now, because judgment has not yet been pronounced in the appeals of The Gaslight and Coke Company against the increased valuation which had been put on the undertaking by the City of London Union and other Metropolitan Local Authorities. The hearing of these appeals has been one of the events of the year; and we mention the matter here as well as in connection with litigation, because, after all, the issue has more to do with the price of gas in London than with any particular point of law.

There has been no new legislation of a general character specially bearing upon the gas industry. The attempts of The Gaslight and Coke Company and the Brentford Company to procure an alteration in the form of statutory cutting-off notices, failed through the disinclination of Parliament to alter general statutes at private instance. The most noteworthy pieces of Private Bill Legislation of the year were the Bristol and Salford cases. In the former, permission was accorded for converting a Gas Company's 10 per cent. stock into an equivalent amount of 5 per cent. stock; and in the latter, Parliament once more looked benignly upon the efforts of suburban Local Authorities "rightly struggling to be free" from bondage to a central Municipality in the matter of gas supply. An important parliamentary campaign, which has lasted through several sessions, was terminated by the acquisition of the undertaking of the Partick, Hillhead, and Maryhill Gas Company, Limited, by the Glasgow Corporation. Neither in the Law Courts did the gas industry figure largely last year. The Salford Corporation and their coal contractors gave some occupation to the Courts; and the prosecution of a contractor for an alleged attempt to bribe the Manager of the Salford Corporation Gas-Works was the first case under the Act for preventing bribery of municipal officers, &c., which was itself an outcome of the old Hunter scandal. The Dublin Gas Company vainly

sought to make a town councillor answer to the law for obnoxious observations upon the character of the Board, uttered in his public capacity. A ridiculous prosecution of a sulphate of ammonia manufacturer by the Excise Authorities for the West Riding helped to define the law relating to "stills." The question of intimidation in connection with labour disputes was dealt with in connection with the cases of Curran and Connor. The great assessment appeals have already been mentioned; and it is to be regarded as a distinct misfortune, by those professionally engaged in this class of business, that the rise of price by The Gaslight and Coke Company should have been announced before the County Magistrates had pronounced judgment in this matter. The scarcity of gas cases in the Law Courts, although it might be more directly explained as due to the absence of serious contentions, nevertheless accentuated the growing distaste on the part of the public for this means of settling commercial disputes. The old sittings of Superior Judges at the Guildhall of the City of London were revived during the year, admittedly in order to attract mercantile cases to the legal tribunals. The effort only showed more plainly, however, that, by the modern custom of inserting arbitration clauses in commercial and industrial engagements, the business community is revenging itself to some purpose for "the "law's delays," which still continue to disgrace the judicial system of this and other countries.

The record of the discoveries and inventions of the year is mainly a story of progression along lines that had been already opened up. The enrichment of gas by liquid hydrocarbons instead of cannel, and the development of the apparatus therefor, occupied the attention of the gas engineering world concurrently with the questions of inclined retorts and of carbonizing machinery. The process of suppressing or modifying the external guide-framing of gasholders was also carried forward a few stages. The manufacture of carburetted water gas as an adjunct to the ordinary coal-gas plant was actually started in some London gas-works; but with what results it would be premature to say. Photometrical developments also attracted much attention, as already remarked; and the revival, in an improved form, of the Welsbach incandescent gas-lamp gave a decided impetus to the consumption of gas in certain places where the competition of the electric light was particularly keen. The discovery of coal in Kent seemed likely to affect the future of the gas industry in the south-east of England. The expiry of the "Otto" gas-engine patent was the signal for the appearance of a swarm of novel patterns of gas and petroleum motors; and the fact that engines using "Dowson gas" were made to develop 100-horse power with a very low consumption of coke in the gas-generators, indicates the probability that the remaining years of the century will see a great development in this order of motors. The high price of house coal also encouraged a growth of the briquette fuel industry, which has now become a considerable trade. Cash prepayment gas-meters grew in favour; and several well-intentioned advances towards the popularization of gas by placing it more easily within the reach of the people were made in various localities.

The Gas Institute held a successful meeting in Carlisle, under the presidency of Mr. Joseph Hepworth, of that city, who approved himself an able, strong, and judicious head of this somewhat unwieldy organization. The reception accorded to the Institute by the local authorities and people of Carlisle, for Mr. Hepworth's sake, was conspicuously genial and kind. Mr. Hepworth was succeeded in the chair of the Institute by Mr. W. A. Valon, of Ramsgate, whose election was also extremely popular. The Institution of Gas Engineers had their inaugural meeting in London in May, under the presidency of Mr. G. C. Trewby, Chief Engineer of The Gaslight and Coke Company; and the gathering was in every respect satisfactory, and promised well for the future of the new technical society. Unfortunately, it was found impracticable to hold an autumn meeting of the Institution in Liverpool, as had been arranged. The North British and the various District Associations of Gas Engineers and Managers throve during the year, and added much, by their published Transactions, to the technical literature of the gas industry. There are now ten organizations of the kind, all told, in the United Kingdom, duly equipped with permanent and transitory officers, and all the usual machinery for the collection and discussion of papers. In addition to these special societies, there are those Institutions of wider scope, like the Institution of Civil Engineers, the Society of Arts, the Society of Chemical Industry, &c., which devote their attention occasionally to gas matters; and thus it is no wonder that the pages of the JOURNAL are filled with reports of the doings of these agencies for furthering technical instruction. The same activity in similar matters has prevailed all over the civilized world; and thus, wherever he may be stationed, the gas engineer can always correspond with some centre of professional intelligence, constituted for his guidance.

The list of casualties and accidents in gas-works and in connection with the use of gas is happily short. At the beginning of the year, the experts called in to investigate the destruction of two gasholders at the Dawsholm works of the Glasgow Corporation reported that in their opinion the catastrophe was due to an incendiary use of dynamite; and nothing has since transpired to shake this explanation. Two incidents of collapse and settlement of holders with overground tanks and self-supported guide-framing occurred on the Continent, to emphasize the need for caution in the erection of this class of holders upon bad ground. Unfortunately, the balance of disaster in connection with gas supply, which was quite insignificant in relation to the manufacturing side of the industry, was redressed by a serious catastrophe at Blackburn, where unlawful meddling with the connections of a consumer's meter led to an explosion which wrecked large business premises, and caused deplorable loss of life and personal injury. There were the usual average of minor explosions in consumers' houses, mostly due to searching for leaks with a naked light. On the other hand, petroleum lamps were responsible for the death and disfigurement by burns of an increasing proportion of the community; while electric lighting apparatus also claimed its victims. The truth of this matter seems to be that every advance of our material civilization is attended by increased risk to the person, much of which represents the tax paid by stupidity to convenience. Casualties from the use, or rather the misuse, of the appliances of civilized life, make a great noise in the world; but they represent, in general, only a fractional side of the case for such conveniences.

The development of electric lighting during the year is a subject upon which we do not profess to be able to pronounce a disinterested opinion. We do claim, however, that our natural sympathy for gas does not prevent us from speaking the truth, as we see it, with regard to a supposed rival industry, although it predisposes us to pay particular attention to that "seamy side" of electric lighting which unquestionably exists, but which hardly any publication except the JOURNAL takes the trouble to notice and discuss. It cannot be gainsaid that electric lighting has made decided progress during the past year, although it is by no means easy to determine the exact bearing of the present position of this industry in Great Britain upon the older one of gas lighting. There have been no new discoveries in electric light engineering; so that the industry which is guided by this branch of science stands precisely upon the same footing, technically considered, as it did at this time last year. Indeed, one of the best known of electrical engineers not long ago went almost out of his way to point out that one of the youngest of the Metropolitan central station electric lighting companies—the Westminster—has been equipped with plant designed upon the same lines as those laid down for a very similar undertaking in the same neighbourhood ten years ago. A good deal of work has been done during the year by the electrical construction companies. Hardly one new municipal central lighting station was opened for business; but several were begun, more were decided upon, and many Provisional Orders under the Electric Lighting Act were applied for and obtained, mostly by local authorities. A suggestion for utilizing gas-engines for creating the electric light in small town stations was advanced by Mr. Denny Lane, of Cork; and it is understood that the Cork Gas Company intend to put this idea into practice, if Parliament permits. Some sensation was created in technical circles by the exhibition at Frankfort-on-the-Main of a "multiphase" system of generating and distributing electricity; and M. Nikola Tesla's experiments in the United States in connection with lighting by "influence," were also noteworthy. It is nevertheless plain that the problem of commercial success with electric lighting will have to be worked out

upon the well-known lines, and that the question of dividend-making mainly involves factors the nature and value of which are perfectly well understood. How to get a paying working load for a central lighting station is the *crux* of the matter. The popularity of electric lighting by what still appears to be the only practical method—the incandescent lamp—is doubtless affected by the price of the service, which is two-and-a-half to three times that of the equivalent of gas. But this consideration chiefly bears upon the selection of districts in which electric lighting plant is to be laid down. Wherever money is an object, wherever people have to struggle to make both ends meet, the cost of electric lighting must be a complete bar to its adoption. There are localities, however, more especially in London, where the cost of electric lighting will be almost the last thing thought of by possible users. If the wealthy clubmen and inhabitants of St. James's, for instance, take a fancy to the electric light, they will no more regard its cost than they do that of a favourite brand of cigars or a pet vintage. Even so, the tribulations of the central station manager are not removed. He has still to face the trouble of the "load factor," which means that at some hour of every day, albeit only for a few minutes, he must employ the maximum productive power corresponding to the total number of lamps on circuit. This can, of course, be done at a price; but at what price? The question is often asked whether the competition of the electric light companies is yet felt by The Gaslight and Coke Company; and it is impossible to speak positively upon this subject. But Continental experience shows that even where electric light is at its best, and gas is heavily taxed and dear, the domains of the systems hardly interfere with each other. If all the rich people in London were collected into one parish, and had the opportunity of a good electrical service, it is probable the local revenue of the Gas Company would show some falling off, although by no means to the extent that might be supposed, because the richest householders often have a keen eye to economy in connection with the lower regions and offices of their houses. But it is the difficulty of electricians that this condition is nowhere fulfilled; for even in the wealthiest quarters of London there is a background of business and private premises unavailable for their purposes. It is possible to assert with truth, therefore, that it is anything but plain sailing yet for the electric light industry; and nothing in particular has transpired during the past year to make the course any easier. The electric lighting of the City of London went begging for years, and was only undertaken at last by dint of much "financing," in which the ex-Lord Mayor had a hand. Also, the London Electric Supply Corporation—the largest of the Metropolitan ventures of the kind—got into serious trouble. The electric lighting stocks that stand at a premium or at par in the market can still be told on the fingers of one hand; and although municipal corporations still press to take up Provisional Orders, through fear of speculators, it is almost as doubtful as it ever was whether any particular electric lighting venture contains within it the possibility of earning a dividend, or even of paying its running expenses. It is at least clear that this desired consummation is more a matter of the district than of the system employed. This is as much as to say that, although the technical question is practically solved, the commercial one is as doubtful as ever it was.

The tale of deaths of those whose names have been known to readers of the JOURNAL, on account of their connection with, or their interest in, the gas industry and the allied professions and trades, is rather longer than usual, owing to the irruption of influenza which rendered the year a memorable one in the annals of pathology. Among the prominent workers in gas engineering in their time we have lost Mr. J. K. Watson, of Edinburgh—a fine example of the old school of gas management; and the same may be said of Mr. E. H. Thorman, late of West Ham, and Mr. W. H. Willis, of Yarmouth. Mr. J. Deakes, of Worcester, was one of the best-liked men in the profession. Mr. Alfred Hersee was, in his day, a prominent personage in the little world of Metropolitan gas administrators. Mr. J. T. Browning was a well-known West of England gas manager. Mr. N. Meiklejohn, Mr. A. Penny, and Mr. J. H. Cox, jun., exhibited the ruthlessness of Fate, that spares youth no more than age. Mr. S. Barratt, of Manchester, was a popular man in his district. Among the order of gas directors and committeemen whose places fell vacant during the year, mention must be made of Mr. Stephenson Clarke—although it was in his capacity of Prince of Coal Contractors that Mr. Clarke attained fame. Mr. Alderman Lamb, of Manchester, had a great deal to do with the administration of the gas supply of that city. Mr. James Beal would have had a finger in that of London, if he had been permitted by circumstances. The death of Dr. Otto, the inventor of the gas-engine which will immortalize his name, also calls for mention here. Mr. W. Richardson, of Birmingham, and Mr. Henry Cockey, of Frome, were links between the gas engineering of the past and the present.

Several important personal changes occurred during the year in the ranks of the gas engineering profession. Mr. J. Birch Paddon succeeded Mr. Clarke on the Board of The Gaslight and Coke Company. Mr. G. C. Trewby was relieved of the responsibility for the carbonizing work of that Company, and was made Chief Constructing Engineer. Mr. John Methven was placed in supreme charge of the Beckton station, in addition to that of Nine Elms. Mr. A. Kitt retired from the management of the Pimlico station of the Company. and was succeeded by Mr. Lacey. An alteration was made in the status of the Station Managers, whereby they became more independent than formerly, and consequently more responsible. Mr. G. F. L. Foulger was appointed to the control of the Distribution Department. Mr. G. Ernest Stevenson, late of Buenos Ayres, went to Rochdale Road, Manchester. Mr. S. Meunier went from Birmingham to Stockport, and Mr. R. V. Milne became Superintendent of the Adderley Street station of the Birmingham Corporation. There were many minor changes in the ranks of the subordinate officers; but one change which we should have most liked to see did not take place, and that was a general improvement in the pay and position of gas-works officials employed by local authorities. There are not half-a-dozen corporations in the United Kingdom who pay their gas managers well enough to deserve the services of good men, and to make the duties attractive to gentlemen of character and education. At present, when such employers are in Parliament, or experience any other trouble, they fly to consultants who have been trained in the service of good companies; but what they will do when the existing generation of experts dies out is not pleasant to contemplate.

And now our brief glance over the incidents and events of the past year, which we chronicled as they occurred, must be stopped—more for lack of space than for want of matter. With the New Year, the JOURNAL will be improved in one or two respects; but it will, in the main, continue to be conducted upon the old principles of showing fair play and no favour to all persons, concerns, and subjects which come under notice. It is for us a subject of satisfaction to reflect that, during the year that has nearly passed, the JOURNAL has been the medium of enriching the literature of gas engineers with more matter of an important and interesting kind, and especially with more original matter, than any previous yearly volumes have contained. This is a sign of the continued growth and sustained vitality of the gas industry, which we are proud to serve as well as to represent. We claim to be a necessary for all persons identified with the supply of gas in the United Kingdom and beyond; from the Chairman of the Board to the lamp-lighter—from the coal-owner to the gas-fitter. The fact that the JOURNAL has grown with the industry, as a glance at our portly half-yearly volumes will show to be the case, is, to a highly practical age such as the present, the best possible proof that both the industry and its organ fill a useful place in the world—a place which, we may be pardoned for saying, neither means to yield.

Calvert's Mechanics' Almanack and Workshop Companion for 1892.—This little almanack, which has reached its nineteenth year of publication, contains practical, technical, and industrial information especially compiled for artizans and handicraftsmen. It may be had of the author, Mr. J. Calvert, 99, Great Jackson Street, Manchester.

The Self-Purification of Rivers.—The systematic investigation of the self-purification of rivers has been recommended by the German Society of Public Health. The Society passed a resolution at the last annual session, requesting the Government Board of Public Health to make these investigations on all rivers receiving sewage, since the scope of the work was too great for private persons to undertake, and the results would be of national importance.

WATER AND SANITARY AFFAIRS.

THE year that is now passing away opened with ample indications that the long-controverted subject of the Metropolitan Water Supply would be forthwith brought before the notice of Parliament by parties more or less antagonistic to the existing Companies. The agitation had been rife in the previous session; and it was about to take a yet more definite form. The London Water (Meter) Bill, prepared by Mr. Blundell Maple, had already passed the first reading; and the Water Companies' (Charges) Bill of Mr. Causton had reached the same stage. The Metropolis Water Supply Bill, virtually prepared by Mr. James Beal, and adopted by a Committee of Vestry delegates, had been duly advertised as a Private Bill, but was afterwards brought forward as a public measure. The Corporation of the City had lodged a copy of their London Water Commission Bill in the Private Bill Office; and, altogether, there was every prospect of a vigorous, if not a decisive conflict in the approaching session. In the meantime, the Government had been asked by Sir John Lubbock, in the name of the London County Council, to undertake an inquiry into the entire question. The receipt of the letter was acknowledged; and this particular effort produced no apparent result. The London Water Companies were bound to recognize the peril by which they were beset; but the whole affair proved in the end to be a mere reconnaissance in force, if indeed it amounted to so much as that. The Southwark and Vauxhall Company had a Bill of their own, of the usual kind emanating from a London Water Company; and this passed through Parliament without undergoing any very material change. By the end of January, the Bill of the Vestries was read the first time; and Mr. W. H. Smith intimated that all Bills relative to the Water Supply of London would be referred to one Committee, as soon as they had passed the second reading. Though it was not stated, it was possibly considered by the Government that this was an amply sufficient answer to the request of the County Council for an exhaustive inquiry. A Hybrid Committee was appointed, of which Sir Matthew White Ridley became the Chairman; and to this Committee all the Water Bills affecting London were referred. The policy of the Government was further indicated by the instructions given to this Committee, on the motion of Mr. Ritchie, stating that they had power to inquire into all matters connected with the nature, price, management, sources, and sufficiency of the Water Supply of London and its suburbs, and also to insert in the Bills brought before them such provisions in connection therewith as in their judgment were expedient. By the terms of the Metropolis Water Bill, it was proposed to create an authority entitled the "London Water Trust," representing the water consumers as well as the inhabitants of the Metropolitan water area. It was to be obligatory on this Trust to take steps, within two years after the passing of the Act, to purchase the undertakings of the Metropolitan Water Companies, by agreement if practicable, failing which, recourse was to be had to arbitration. A singular provision at the close of the Bill was that the London County Council might, by resolution, invest themselves with the powers contained in the Act (supposing the Bill to pass), and so take the place of the Trust. But the County Council refused to be flattered by this proposal, and set themselves to oppose the measure to the uttermost; having an especial antipathy to the proviso that they should, at an early period, purchase the undertakings of the Water Companies.

There is no doubt that the Bill of the Vestries was intended as a conciliatory measure, both towards the Companies and the County Council. But it failed on all sides; and it is a somewhat painful coincidence that Mr. Beal, who so largely inspired the measure, died while his expectations were being thus frustrated. The Bill of the Corporation had a more potent effect, though in the form it originally assumed it proved unacceptable. The curious part of this attempt was that it led to an alliance between the Corporation and the County Council. How the ill-assorted pair will ultimately work together is somewhat doubtful, and may be found to depend upon the character of the Council to be elected next March. The London Water Commission Bill of the Corporation, as laid before Parliament, was but a halting measure, proposing a Commission possessing power to introduce Bills affecting the water supply. What these Bills might be, remained undetermined. They might include the purchase of the existing works, or provide for an independent supply. Dissatisfied alike with the Bill of the Vestries and that of the Corporation, the County Council, having no power to promote a Bill of their own, nevertheless caused Sir John Lubbock to introduce a Public Bill by which this disability was to be removed. This measure was distinctly avowed to be a County Council Bill. But it was blocked; and, as stated by one of the Committees of the Council, "no assistance was given by the Govern-"ment." Accordingly, the Bill never passed a second reading; and the Select Committee made no acquaintance with it. The Government are not exactly agreed among themselves on the water question, if we may judge by the opposite utterances of Lord Salisbury and Mr. Ritchie; the former having no particular admiration for the London County Council, while the latter looks upon that body as the proper possessor of the water supply. Concerning the Select Committee to whom such extensive powers of inquiry were extended, in order that they might show the way out of the labyrinth into which the subject had been thrown, they adopted on some points a very summary method. They met for the first time on the 15th of April, and then adjourned to the 28th, when they heard the speech of the Counsel appearing for the City Bill. At its close the Chairman announced that, in the opinion of the Committee, no Bill could be satisfactory which merely constituted a Public Authority to promote Bills in Parliament. To this the Chairman added: "Practically, that "means we cannot see our way to passing the preamble "of this Bill." A very few days afterwards, the County Council proceeded to re-arrange their plans. They met twenty representatives of authorities belonging to the water area outside London, and obtained their agreement to three resolutions. They also entered into close conference with the Corporation of the City, and formed a compact by which the City Bill was to be amended, so as to include the appointment of a Water Committee, seven-eighths of the members to belong to the County Council, and the remaining eighth to appertain to the Corporation. The Committee were to have power to purchase the undertakings of the Water Companies; but there was to be no compulsion on either side. The City Bill, thus altered, was laid before the Select Committee; but the latter, while slightly approving, declined to proceed with it. In the meantime, a large amount of evidence had been taken in relation to the Vestries' Bill, and yet further evidence was gone into; but on June 26, the Committee finally decided that neither the preamble of the City Bill nor that of the Vestries Bill had been proved. All the fruit of a long inquiry relative to six Bills was the passing of one, and that belonging to a Water Company. Perhaps we ought to count among the results the report of the Select Committee. But this was a singularly inert document, though in some respects it was rather commendable. Sir Matthew Ridley himself declared that the inquiry was incomplete, the quantity and quality of the supply having received no consideration. The report excited a general feeling of disappointment. It approved the idea of a Water Committee identified with the County Council and the Corporation, and recommended that the new Water Authority should be required to purchase the undertakings of the eight Companies, by agreement or by arbitration, within a fixed period. The report also recommended, in effect, that the County Council should be empowered to carry out such an inquiry as would complete what the Select Committee had left undone. But, on the whole, the Committee showed a very small result, considering the extraordinary powers with which they were invested.

The introduction of the London Water Commission Bill and the Metropolis Water Supply Bill, to say nothing of lesser measures, in the past session of Parliament, and the appointment of the Hybrid Committee with such extensive powers, have been the cause of heavy expenditure on the part of the Water Companies, for the legitimate purpose of defending their interests. The County Council, as represented by their Special Committee on Water Supply, have complained that the Select Committee presided over by Sir Matthew Ridley "stopped the inquiry "before hearing the evidence of the Companies," and so deprived the Council of the advantage which they would have derived from knowing what case the Companies were prepared to set up. The latter no less complain that

they incurred all the trouble and expense of preparing their case, with the necessary aid of Counsel and witnesses, and yet were told, after a period of many days, that their evidence was not wanted, and its absence would not affect them. Of course, this could not be foreseen, or a large expenditure of money, and no small amount of trouble, might have been spared. The Chairman of the Select Committee distinctly declared that nothing had been alleged which called for any defence on the part of the Water Companies. But there is to be a further attempt next year. Letters in *The Times*, speeches in the County Council, reports of Committees and officers of that body, and certain proceedings on the part of the Corporation, represent so much skirmishing before the grand attack. Sir Thomas Farrer, the late Mr. Haggis, and Mr. Binnie (the Engineer of the Council), have all thrown down the gauntlet to the Water Companies; and the Corporation have now agreed with the Council to bring in a Bill to authorize the appointment of a Water Committee, similar to that previously named, and to enable the Council to promote Bills relative to the Water Supply of the Metropolis. In accordance with the policy of the Council, into compliance with which the Corporation have been obviously forced, the purchase of the existing works is made extremely remote and contingent. The Water Committee is to have power to conduct the further inquiry proposed by Sir Matthew Ridley's Committee, and to do sundry other things amounting to a positive interference with the affairs of the Water Companies. In its aspect towards the Companies, the Bill differs very essentially from the recommendations of the Select Committee. The whole design is to bring into play certain machinery which shall enable the County Council to obtain possession of the water supply without making proper compensation to the Companies. The intentions of the Council, especially on the subject of purchase, are made evident by the four resolutions adopted in October, at which date *The Times* declared that everything relative to the water question had been thrown into "a welter of confusion."

A supply of water to be obtained from the mountainous districts of England or Wales, and made to replace the supply now given to London from rivers and wells, is an idea very popular in certain quarters, and ostensibly entertained by the London County Council. The Corporation of the City have long been seeking a supply nearer home, though necessarily a small one, by sinking a deep well in the neighbourhood of Aldgate. The perils which beset a supply drawn from a distance were shown in a very forcible manner during the latter part of last winter, when the water supply of Plymouth by way of the Leat was entirely intercepted by the presence of snow and ice. The costliness of a remote source is shown in the case of the Vyrnwy project, which has now absorbed more than £2,000,000, although not yet complete. Comparing the populations, it will be seen that the London works have cost much less in proportion. The Birmingham project for a supply from Mid-Wales exhibits a similar feature. Encroachments on various water sheds for the supply of distant towns have been a subject of discussion during the year; as also the proprietorship—if there be any—of underground waters. An event to which some interest attached was the Seventh International Congress of Hygiene and Demography, held in London during the autumn, at which Dr. Percy Frankland was prominent. With respect to the sewage question, much is still said about the pollution of the Thames by the Metropolitan outfalls, to which the County Council reply that their precipitation works at Barking and Crossness are not yet in full working order. We can only say it is time they were. An important report presented to the Council in the spring of the year by Sir Benjamin Baker and Mr. Binnie showed that the main drainage works of the Metropolis required certain additions, involving an outlay of about £2,250,000. This was a work to be entered upon at once. By-and-bye it would probably be necessary to construct a supplemental outfall at Shell Haven, in Sea Reach, for which the capital outlay would be about £1,600,000, with a working expenditure of £30,000 per annum. The Water Companies are evidently pouring into London a flood which is overtaking the capacity of the main drainage works.

West Ham Gas Company.—Mr. John Thorman, who was for many years Assistant Engineer under his late father, has been appointed Engineer to this Company.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1192.)

LAST week—being about the foggiest on record, and being also Christmas week—was much hampered in regard to business. Many members had started for their holidays; and many others, left in London, found the weather too bad to face. Though dealings were thus naturally much restricted, the tendency was nevertheless favourable on the whole; and prices for the most part closed a shade better. Money was in better demand; and, the supply of gold being less, rates were appreciably firmer. In the Gas Market there is nothing of much interest to chronicle; and changes of quotations are few and slight. Gaslight "A" has not fallen any further—remaining very steady at about 222. The weather has to some extent had a favourable influence on the price; for many of the public have a very exaggerated notion with regard to the profit resulting from a protracted fog. One fog no more makes a winter than one swallow makes a summer. No business was done in the debenture or preference issues; and a single bargain in the "H" (which fell 1) covered the rest. In South Metropolitans, there was a weaker tendency in "B;" the quotation receding 2. It is possible that this was inspired by a fear that an increase in the price of gas from the new year would be announced by this Company also—an apprehension for which there is not the slightest foundation. The debenture stock was rather more active and firm. Commercials were not noticed. A few transactions at average figures relieved the Suburban and Provincial list from stagnation; but no feature of interest was developed. The Continental companies were quiet and steady. Of the Indian division, Oriental improved ½. Of the South American, the only one which attracted business was Monte Video, which, however, evinced no sign of recovery. A small amount of business has been done among the Water Companies, with a somewhat improving tendency; indeed, it is difficult to see what solid ground for the recent depression actually existed. Kent has recovered 3; West Middlesex, 2½.

The daily operations were: Gas was very quiet on Monday; but prices were mostly very fair, and quotations closed as they opened. The improvement in Water quotations noted above was effected this day; and East London's quotation was drawn closer—showing a nominal retrogression of ½. Gas was in about the same position on Tuesday. A few of the issues changed hands at the old figures ruling, without any shift in the quotations. In Water, East London rose 1. Business in Gas remained much the same on Wednesday; the only variation being a fall of 1 in South Metropolitan "B." On Thursday, South Metropolitan "B" receded 1 more; and Gaslight "H" lost a similar amount. Oriental improved ½. Nothing was done in Water; and quotations closed unchanged.

STANDARDS OF LIGHT.

OUR study of this question last week, brought us down to the time when the convenience of the candle unit, in contradistinction to the carcel unit, was being recognized all over the world. The carcel vanished from Germany, on gas manufacturers there making a well-intentioned, but futile effort to obtain a satisfactory standard candle for gas-testing purposes, by importing scientific exactitude into the methods of candle making. The German candle was made of paraffin; and whereas in English practice the candles are assumed to be giving a proper flame if the rate of consumption of material falls within given limits, the German practice was to measure also the height of the candle-flame. Even in France, standard candles were legalized for gas testing under many concessions. American technicians never used any other unit of light than the candle. The result of the attempt of a Congress of Electricians held in Paris in 1884, to impose the Violle standard of light upon the scientific world, is instructive. This standard is the amount of light radiated from an area of one square centimetre of the surface of molten platinum on the point of solidification. It was adopted with enthusiasm by one congress, but rejected by another, which met in the following year, and recommended the retention of the carcel standard. Neither recommendation has been adopted; but French science has arrived at the following compromise: Constrained by force of circumstances to adopt the candle unit, French technicians have ingeniously allied the candle to the metric system and the Violle unit, by agreeing to take as the practical unit of light, under the name of the "decimal candle," the twentieth part of the Violle standard as defined in 1884. The candle, however, is not "decimal" with reference to the Violle unit, but to the carcel; and a sacrifice of exactitude has been made in order to arrive at the apparent agreement expressed in the following comparison: Violle, 1; carcel, 2·08; decimal candle, 20. Carcel, 1; Violle, 0·48; decimal candle, 9·6. Decimal candle, 1; Violle, 0·05; carcel, 0·104. To all intents and purposes, the French decimal candle is only the English candle unit under a name that preserves the *amour-propre* of the scientists who committed themselves to the adoption of the Violle standard, and then of the carcel, only to discover that in France, as elsewhere, the work-a-day world prefers to measure its lights by the intelligible and convenient candle unit.

German technicians, disappointed in their efforts to produce a reliable candle, are trying to satisfy themselves with the amyl-acetate lamp of Hefner-Alteneck; but almost the only recommendation possessed by this standard is its simplicity. It is merely a sponge lamp; but the colour of the amyl-acetate flame is bad; and it has quite recently been ascertained that small differences in the composition of the combustible, exert a great effect upon the illuminating power of the flame. There is no likelihood of the Hefner-Alteneck lamp being adopted out of Germany. The same may be said of the Dutch imitation of this standard. If we are to have an actual embodiment of the candle unit, therefore, there does not appear to be any better means of obtaining it than by pentane, which has the additional recommendation, not yet stated, of giving light the same colour as good gas; that is, it is much whiter than candle or lamp light, and is fully as bright as the best incandescent electric lamp.

Fortunately, during the past few years, a radical improvement has been effected in the production of the pentane air-gas standard. The form of a lamp has been adopted for the new type of pentane standard apparatus; and the Methven principle of only using a portion of the flame has also been followed—the whole arrangement having the simplicity and independence of the amyl-acetate lamp. The lamp is manufactured by the firm of Woodhouse and Rawson United, Limited; and it remains substantially as described and illustrated on p. 116 of Mr. Dibdin's book. In this lamp it would appear that the practical photometrist has at last everything he desires in a standard light—reliability, simplicity, portability, and, not least, economy. The arrangement may be briefly described as follows: There is a glass lamp-body to contain pentane, of which it will hold (say) half a pint, or enough for a day's work. An ordinary solid round wick dips into the fluid, and is carried up into a tube of ¼-inch diameter, having an ordinary wheel attachment for raising or lowering it. The wick-tube is of exaggerated height, as compared with ordinary lamps, and the wick does not reach to the top of it, where we see the well-known pentane gas-burner consisting of a ¼-inch hole in a 1-inch brass tube. Outside this tube is another, forming a jacket, the top of which is cut off square at a level a little above the top of the pentane burner; and higher up still is a metal chimney, the position of which can be raised or lowered with reference to the top of the tube, so as to show a gap of varying width between them. In the side of this chimney is a small slot about ⅜-inch long, commencing about 1 inch above the bottom of the chimney.

The action of the lamp is strictly that of an air carburetter, and it is truly a gas-flame that is shown; the purpose of the wick being merely to assist and to regulate the evaporation of the pentane, not to carry the flame as in the case of an ordinary lamp. It merely raises the spirit to the level where the heat of the surrounding metal tubing vaporizes it quickly, and where it mixes with the warmed air that also feeds the flame. To light the lamp, it is desirable to warm the jacket by means of an atmospheric gas-flame, or other convenient means, and then let it cool down to a warmth that can be borne by the hand. The evolving air gas will now readily ignite at the top of the burner proper, which is invisible from the outside. The flame, at first too long, soon shortens until its tip is just visible through the little slot already described as being cut in the side of the chimney. The standard is then fit for use. All that is visible of the flame is the portion between the top of the jacket and the bottom of the chimney, which is in appearance a motionless, naked rod of white flame. The length of this visible portion of the flame can be altered, in accordance with gauges sent out with the instrument, so as to give exactly the light of ½ candle, 1 candle, or 1½ candles, as may be preferred. Mr. Dibdin speaks very highly of this embodiment of the pentane standard; and well he may, for it is simplicity itself. There are no troublesome adjustments to make for varying temperature or barometrical pressure; and all the objectionable *impedimenta* of the standard, and the careful preparation of the air gas, are reduced to filling the lamp, lighting it, and adjusting the height of the wick by the screw until the tip of the flame can be seen in the slots provided for the purpose. So long as the tip can be seen here, no matter whether it approaches the top or the bottom of the slot, the operator can go on with his work assured that his standard is constant. The proof of this efficiency and convenience of the new pentane lamp lies in the fact that by at least one London Gas Company it is exclusively used, having supplanted the Methven screen.

The pentane, it may be as well to remark, can now be obtained under guarantee as "standard." It is a highly volatile petroleum spirit, obtained by rectifying gasoline. Its specific gravity may vary between 0·628 and 0·631 at 59° Fahr.; but, as generally sent out, it is at the higher figure. There is no great nicety required in this respect, since air gas of the same illuminating power is obtained with samples varying in specific gravity between 0·614 and 0·646. It has the characteristic odour of petroleum spirit, and volatilizes so readily at ordinary temperatures that, if dropped slowly from a bottle held at arm's length, hardly a single drop will reach the floor. It is, in every respect, a preferable material to amyl-acetate to work with.

It will consequently happen that the pentane standard of light will come before the new Board of Trade Committee in a much more attractive guise than it could command ten years ago; and there is little doubt that it will obtain their suffrages. There is reason to believe that electricians as well as gas engineers would welcome a definite pronouncement respecting the standard of light. Unless something altogether novel and unexpected presents itself in the course of the Committee's inquiry, we shall look for their finding on something like the following lines: (1) That the standard unit of light for the United Kingdom shall be the mean light of the actual parliamentary standard candle. (2) That this unit can be best represented, in the present state of knowledge, by burning a mixture of pentane vapour and air, either previously mixed as air gas, or formed as required by a special kind of lamp, in manner to be stated. (3) That standard pentane lamps of approved design shall be stamped by the Standards Department.

If this is done, it will probably be only a question of time for the pentane standard to obtain universal acceptance. It is just fifteen years ago since Mr. Harcourt first brought forward his suggestion for a standard in the form of an air-gas flame, and he has adhered to his project through no small amount of hostile criticism, and even more disheartening neglect, improving the form of his apparatus as defects were recognized, until now he is within measurable distance of seeing the realization of his aim. Even Mr. Harcourt would probably admit that it would have been a misfortune if pentane had been forced into employment as a standard before it had commended itself to independent opinion on its merits. It might have been used as a standard of light ten years ago and more; but it would be affectation to say that it had at that time anything like the claims to the favour of photometrists that it has to day. We do not expect that the new Board of Trade Committee will extend their labours over a very long time, or take into their purview too large a field. They will find it unnecessary to "slay the slain" by proving once more the unreliability of the candle. All they need do is to examine the available substitutes for the candle; and of these it is clearly apparent that pentane, and the pentane lamp, occupy far and away the best position.

It is not a point on which the Committee will be likely to take much notice, but it is at least worth stating here—that the pentane standard is very much cheaper in use than any other, with the sole exception of the Methven, which, on the other hand, is practically "out of court" on other counts. Candles come very expensive in the long run, as the London Gas Companies know to their cost; seeing the number that have to be rejected as unsuitable. If a reliable standard were as costly as the molten platinum device, however, it would pay the Companies to adopt it in default of others; for the consequential expenses of working to a variable standard would very much more than pay all possible costs of testing in any year. During the decade that has passed since the last Board of Trade Committee inquired into the subject of gas-testing, and recommended the abolition of candles, these unsatisfactory guides have caused a waste of tens of thousands of pounds by the Gas Companies of London alone. It may be hoped that this state of things will be rectified as the result of the findings of the new Committee, whose report will have the additional weight of the preparatory statements of their predecessors in the field.

The Electric Light in Fog.—The electric lighting of the City was put to the test last week during the foggy weather which then prevailed; and we think its most ardent admirers will scarcely be prepared to admit that it came out well. The want of penetrability of the light in fog has long been recognized; and this defect was apparent last Tuesday, when the gas-lamps showed themselves far more efficient than their rivals in piercing the gloom.

Alderman Manwaring, J.P., of Brighton, whose death has lately been announced, was a conspicuous member of the Corporation of that borough; having, during a connection extending over nineteen years, served on all the Committees of the Council. His name was associated with every scheme of improvement carried out in Brighton in recent years; and he took a prominent part in movements connected with the gas and water supply and electric lighting of the town.

The Value of Tar as a Preservative.—Some experiments were lately carried out at St. Elroy, in Auvergne, to determine the effect of various preservatives upon wood. Seven woods were selected for the purpose of the experiments—viz., oak 35 years old, oak 27 years old, fir, pine, birch, beech, and poplar. The tests were made on 52 discs, each ¼ inch thick. Two discs of each wood were kept dry above ground, and the remainder were suspended in a cage in a damp mine, having a temperature of about 75° Fahr. Two specimens of each wood were not treated in any way; while the others were protected by one of the following substances: Solutions of the sulphates of iron and copper, solution of chloride of zinc, creosote, oil paint, or tar. The specimens were examined at various periods of from 6 months to 8½ years. The unprotected specimens were all destroyed in from 2½ to 3½ years; the order of durability being about as follows: Beech, oak No. 1, poplar, oak No. 2, birch fir, pine. The preservative effects of tar were found to be as follows—the life of the unprotected specimen being taken as unity: Oak No. 1, 28·7; oak No. 2, 24·6; fir, 263·5; pine, 87·5; birch, 106·4; beech, 26·2; poplar, 150·4. For creosote the figures were 1·7, 0·9, 2·5, 4·4, 0·6, 3·5, 1·3; and they are so remarkably low as to lead to doubt as to the correctness of the experiments.

NOTES.

An Optical Test of the Davy Hypothesis.

Professor G. G. Stokes has communicated to the Royal Society of Edinburgh a short paper on an optical proof of the existence of suspended solid matter in luminous flames; thus constituting a proof of the well-known Davy hypothesis. He relates how having been led in connection with some questions about lighthouses to pass a beam of sunlight, condensed by a lense, through the flame of a candle, he noticed that, where the cone of rays cut the luminous envelope, there were two patches of light brighter than the general flame, which were evidently due to sunlight scattered by matter in the envelope which was in a state of suspension. The patches corresponded in area to the intersection of the double cone by the envelope; and their thickness was insensibly small. Within the envelope, as well as outside, there was none of this scattering. The patches were made more conspicuous by viewing the whole through a cell with an ammoniacal solution of a salt of copper, or through a blue glass coloured by cobalt. In the former case, the light from the flame was more weakened than the scattered light, which was richer in rays of high refrangibility. In the latter case, the patches were distinguished by a difference of colour; the patches being blue, while the flame (with a suitable thickness of blue glass) was purplish. The light of the patches exhibited the polarization of light scattered by fine particles—that is to say, when viewed in a direction perpendicular to the incident light, it was polarized in a plane passing through the beam and the line of sight. When the beam was passed through the blue base of the flame, there was no scattered light. A luminous gas-flame showed the patches, indicating the scattering of light like the flame of a candle, but less copiously. They were not seen in a Bunsen flame, or in the flame of alcohol; but they were well seen in the luminous flame of ether. A Bunsen flame fed with chloride of sodium did not show the phenomenon, although the flame was fairly luminous. The phenomenon here described shows very prettily the separation of carbon (associated, it may be, with some hydrogen) in the flame; and at the same time the extreme thinness of the layer which this forms. It also shows the mode of separation of the carbon—that it is due to the action of heat on the volatile hydrocarbon. At the base, where there is a plentiful supply of oxygen, the molecules are burnt at once. Higher up the heated products of combustion have time to decompose the combustible vapour before it gets enough oxygen to burn it. Professor Stokes suggests that the thinness of the stratum of glowing carbon may be due to its being attacked on both sides—on the outside by oxygen, on the inside by carbonic acid, which with the glowing carbon would form carbonic oxide. Mr. Burch has previously written on the same subject.

The Solidification of Petroleum.

Attempts to solidify petroleum for the purpose of enabling it to be conveniently burnt as fuel, have been made by many ingenious persons. Among the latest is Mr. Chenhall, whose process is being exploited by a company having works at Hackney Wick. The process of converting the fluid into a solid is described as being very simple and rapid. A given quantity of the crude mineral oil is mixed with about 15 per cent. of certain chemicals, which are in themselves largely combustible. The vessel containing the mixture is then placed for a short time in a bath of boiling water, which induces a preliminary fusing of the materials. The next stage is to fire the composition to a temperature of from 400° to 500° Fahr., which is attended with careful stirring. In a short time solidification takes place, after which the compound is pressed into blocks for storing and use. It is stated that the chemicals used for admixture with the petroleum are of about the same value as the oil, and the preparation requires no skilled labour. The whole process from first mixing to solidification only occupies half an hour; and the plant is very simple and inexpensive. The solidified petroleum burns freely, with but a small proportion of ash; and it gives out a heat far more intense than that of steam coal, as can be readily believed. It is more difficult to understand the statement that the commodity can be sold at a price far less than that of steam coal, seeing that crude petroleum cannot be obtained in this country for less than between £3 and £4 per ton, and the selling price of the mixture cannot be less than that of the raw material from which it is made. Sir Edward Reed, Mr. Boverton Redwood, and other experts, are stated to think highly of the Chenhall system, which, if commercially successful, ought to make a mark in connection with the preparation of liquid hydrocarbons for water-gas making.

The Liquefaction of Gases.

The liquefaction of the so-called permanent gases is facilitated for the purposes of lecture-room demonstration by the use of Pictet's fluid. This remarkable product is a mixture of sulphurous and carbonic acid gases, liquefied by cold and pressure. It produces, by its rapid evaporation, an extremely low temperature; being more manageable for this purpose than the well-known mixture of carbonic acid "snow" and ether, by which metallic mercury is often frozen solid upon lecture tables. By the help of mechanical compression to about nine atmospheres, vapourizing Pictet's fluid easily reduces the nitrous oxide gas to a liquid. Then, by the use of this fluid nitrous oxide, a still more intense cold is produced; and under this cold, and at pressures of from 120 to 200 atmospheres, all the gases may be liquefied. Fluid air, the temperature of which is not far from −200° C. is described as a limpid blue liquid, which is made visible to a large audience by permitting some to escape in a bright white light, when a distinctly blue mist appears in the atmosphere, which quickly vanishes, of course, as the vapour diffuses in the air. Coal gas is liquified in the same way, although, owing to the various matters of which it is composed, liquefaction is progressive in this instance.

COMMUNICATED ARTICLE.

SOME PRACTICAL DISADVANTAGES INCIDENTAL TO THE GENERATION AND DISTRIBUTION OF ELECTRICITY TO CONSUMERS.

By Norton H. Humphrys, Assoc. M. Inst. C. E., F. C. S.

(*Concluded from p.* 1130.)

A great deal might be said here on the application of the load factor to the history of a gas undertaking throughout a period of years, and its utility as a means of indicating the effect of certain definite acts on the part of the management—such as reductions in price, changes in quality, introducing schemes for letting apparatus on hire, or otherwise facilitating the use of gas. No doubt, a careful study of a series of such diagrams would give a clearer idea of the numerous causes that have tended to influence the quantity of gas consumed, than could be obtained in any other way. But it is not proposed to follow this direction further than pointing out that the fluctuations shown on the load factor diagram have an intimate relationship to the selling price of the product. A plant of a certain given capacity represents a certain amount of sunk capital; and this capital would not be forthcoming, in the first place, unless there was a fair prospect of a reasonable profit or dividend being earned by its means, We may take a completely equipped gas-works (say) equal to the production and supply of one million cubic feet of gas per diem, as representing a paid-up capital of £200,000 sterling. Five per cent. interest would be a reasonable rate; and the schedule of prices would be so arranged as to admit of a sum sufficient to meet this claim being earned every year. To put it another way, the price would be so adjusted as to leave a remainder of some £10,000, after liquidating all working expenses and charges incidental to the carrying on of the concern. With an annual load factor of the full capacity, an addition of only 6·6d. per 1000 cubic feet of gas sold would be sufficient for this purpose. This, of course, would be unattainable; but suppose we have the good fortune to be able to record an average annual load factor of 0·66. An addition or loading of 10d. per 1000 cubic feet would then be necessary; and if it was not more than 0·5, 1s. 1·2d. would be required. With a low average load factor, the necessary charge assumes considerable proportions. With one of 0·25, it would be 2s. 2·4d.; and with one of only 0·1, it would be no less than 5s. 6d. If the load factor is low, the rate must be high, and *vice versâ*, as it varies in inverse proportion. All other things being equal, a load factor of 0·25 would mean a charge of 1s. 1·2d. per 1000 cubic feet higher than one of 0·5. When dealing with very low load factors, a high price must necessarily be charged. If it is considered that a high price is inexpedient, then the shareholders must be satisfied with a very low rate of profit; or it may even be considered advisable to work the concern temporarily at an actual loss, so as to develop the business and afford opportunities for earning profit in the future.

In all commercial undertakings—whether gas, electric light, or anything else—the first outlay of capital includes preliminary or establishment expenses, comprising several items that are incurred once for all, irrespective of future extensions of business. Besides this, in providing the working plant, there are several directions in which a considerable excess of power can be provided at a trifling additional cost. In the case of gas-works, it is wise to take up a good area of land in the first place, as much difficulty and extra expense would arise in buying it afterwards. The difficulty and expense of laying mains, renders it desirable to exercise a reasonable foresight as regards probable future requirements. No one would dispute the wisdom of so designing buildings that they may be extended in any one direction at a future time, or allowing for the telescoping of gasholders. The first outlay therefore represents a nucleus or nest egg which can be added to at a less than proportionate expense. The cost of doubling the productive capacity of a plant, especially if it was judiciously laid out, with an eye to such a contingency in the first place, need not be so much as half the original cost. In this way an increased business, if it does not improve the load factor, will operate in the direction of reducing the proportion between capital and the annual receipts. It would be easy to quote examples of gas undertakings that have been greatly improved, while the load factor may remain the same, or but little affected. In some districts, the adoption of gas for warming has been so considerable as to entirely neutralize any advantage in respect to summer consumption—for what gas engineers call summer consumption, is the same thing as increasing the load factor—that is gained by the increased use of cooking stoves, as secured by cookery demonstrations, or exhibitions of

apparatus. Or improved lighting appliances may come in with similar effect. There are few undertakings in such a position that the cash value of the load factor must remain a fixed quantity; and therefore it usually turns out that the additional heating and lighting business is a direct benefit to all concerned.

The load factor is, after all, a theoretical quantity, acquiring importance only on account of the money value represented by it. We must consider not only the proportion between capital, as determining the amount required for interest and working expenses, but the value and amount of each as compared with the selling prices which commercial considerations render practicable. For example, there may be a particular commodity not in regular demand, but for which such a price is readily secured as to render any question of working expenses, interest, &c., of no practical importance. If a large profit is obtainable from it, the charges proper to the credit of the revenue account may either consist principally of interest on capital, or be largely made up of working expenses, without affecting the main issues. Either one or the other, or perhaps both, may be so small as to possess no appreciable weight in the matter. It is when we are considering the question of cutting down prices, so as to put the thing on the market at the lowest possible figure, that these factors come in, and every pains is taken in the way, not only of reducing the working expenses, but also of cheapening the first cost of the plant. This may be done by the invention of improved methods of working, or by increasing the productive capacity of the existing apparatus.

If the amount necessary to pay interest is small as compared with the working expenses, then the effect of the load factor on the selling price is also small. Where the converse is the case, and the working expenses are comparatively small, the load factor may assume such proportions as to control the possibility or otherwise of suppling the commodity at remunerative rates. In the manufacture of pure sulphuric acid, for instance, it is said that a platinum still, the joints of which are soldered with gold, is used. The value of the apparatus may be some thousands of pounds; and unless the product admitted of a large profit, it would not be used. As regards the manufacture of gas, it is well known that, with good management, the amount of capital expended need not greatly exceed three times the annual receipts. The electric light industry is not sufficiently advanced to enable one to fix definitely upon a proportion between capital and revenue; but it is safe to say that the load factor is of more importance in its case.

At present, the supply of electricity in England is in the same position as gas occupied about fifty years ago, when it was only used for lighting purposes, and that to a very limited extent; in the United States, I believe, something has been done in the way of electric motor engines. The load factor is therefore low, particularly in country towns. In London, where fogs are frequent, day consumption is occasionally obtainable; but the real requirement is a good demand for electricity, say, for cooking, motive power, or other daylight use. Failing this, contracts for the regular use of the light—like public lighting contracts, covering the whole of the hours of darkness—are the best substitute obtainable. Some of the American electric supply companies have so far recognized the importance of this as to fix their contract prices at so many hours per lamp per day, and to allow large discounts as the number of hours is increased. If the lighting of cellars or underground stations can be obtained, where it would be required during the whole of the working hours, so much the better. But under present circumstances, the commercial possibility of supplying electricity as a paying concern appears to turn upon one of two things—either the load factor must be largely increased by the securing of regular long-hour customers, or else the amount of capital required must be largely reduced by introducing new and cheap methods of generating and distributing electricity.

Of course, there are always a certain number who are willing to take electricity at a high price as an article of luxury. While in fashionable localities, where a large number of the wealthier classes are congregated together, it might be possible to do business on these lines alone, it may be taken that the only way of making a prosperous business in an ordinary district is to cater for the middle classes in addition. With these, at any rate, the question of cost is the chief thing. They are willing to put up with some inconvenience if money can be saved by it; and a promise of indirect economy, by the preservation of gilding, paint, ceilings, or stored goods, does not appeal to them so strongly as a guaranteed cash saving. When the inhabitants of country towns are canvassed by suppliers of electricity, they usually wish to stipulate that it should not cost more than gas. It would be easy to make out a good case for high-power oil-gas on the score of purity, less vitiation of atmosphere, &c.; yet when sold at a corresponding value, light for light, it will not compete with the cheaper though inferior coal gas.

Another practical disadvantage is the absence of a cheap and reliable electric meter, measuring not the current or quantity only, but the actual cash value supplied to within a small percentage, without loss or waste. I may be wrong here, but I believe that the principle at present adopted in measuring electricity as used by consumers is that of bye-passing a known fraction and using it for the deposition of metals. This method is objectionable as being only inferential and wasteful. It is inferential as leaving the bulk of the current untouched, and wasteful in that the portion of electricity used for depositing the metal is unavailable for any other purpose. Possibly, the quantity of electricity so used may be very small—practically of no more importance than the flash-light that is left burning in a large gas-lamp. But in cases of dispute between buyer and seller, there will always be the question as to whether the "fractionation" has been accurately performed. Being intangible and unrecognizable except by the shock or by production of heat, it seems probable that electricity could be more easily wasted than gas by the use of unsuitable or cheap appliances, or by careless or indifferent management. Disputes as to the accuracy of gas-meters are not unfrequent, even now that the construction of them is generally understood; so a measuring instrument on the principle of the present electricity meter would likely come in for even a greater share of odium.

TECHNICAL RECORD.

AMERICAN GASLIGHT ASSOCIATION.

The Annual Meeting in New York.

(*Concluded from p.* 1133.)

Mr. A. B. SLATER, jun., of Providence (R.I.), read a paper on

INTENSITY OF LIGHT.

In the course of his introductory remarks, the author said that one of the principal objects a gas engineer has in view is to secure the greatest amount of illumination for the money expended in the production of the light. After pointing out the dependence of light upon heat for its generation, he proceeded to explain how, when a body is heated, it first begins to glow with a deep red, which, as the temperature rises, passes up through vermilion, yellow, white, and finally to a bluish white—gradually adding to itself the colours of the continuous spectrum in their regular order, from the least to the most refrangible. Not only are the different colours added by the rising temperature—beginning with the red at about 1000° Fahr., and finally reaching the violet at about 2100° Fahr.—but their intensity increases after their appearance; and much more rapidly than the temperature. A gas-light at 2200° emits all the colours given by the arc electric light at 8700°; but the latter has the rays towards the violet end of the spectrum much more intensified than the lower rays towards the red—the difference in intensity of the two lights being due to the difference of 6500° in temperature. With colours of comparatively equal intensity, the yellow is most visible. Hence, with two lights of similar size and density, the eye will pronounce in favour of a yellowish in preference to a bluish tint for illumination. After inquiring what is illumination, the author passed on to examine an ordinary gas-flame as produced by a Bunsen burner, and then proceeded to consider the conditions of good combustion for luminosity (using a flat-flame burner to get a flame of larger size), and to deal with the question of the diffusion of light. His remarks on these subjects were as follows:

The intensity of the light depends upon the degree of incandescence of the minute particles of free carbon rising in the flame; and that is governed by the heat generated, less that absorbed by diluents and excess of air, and also, in case of a bad burner, by the burner itself. The intensity is then in direct ratio to the temperature. The density of the light is equal to the intensity of the light multiplied by the amount of surface of luminous carbon per unit of area; and the quantity of light from any source is equal to the density multiplied by the area of the luminous source as a whole. Hence we see that we have two lights of the same size and intensity, but of different density and consequent illuminating power; the density being the measure of the quantity, and the intensity the measure of quality of the light emitted. This can be proved on the bar photometer by varying the composition of the gas tested. We may say that the illumination of an object is the amount of light received by it, less that absorbed and directly transmitted.

From the foregoing we see that the richer the gas the smaller the burner orifice must, of course, be, or the pressure greater; thereby drawing in the necessary increase of oxygen, which, within limits, will intensify, and thus reduce the space of combustion, and so make the light more dense and intense. The luminous flame grows comparatively less in area. Additional pressure will not cause the air drawn in to increase in the same proportion as the quantity of gas increases, the amount issuing being directly as the square root of the pressure, and inversely as the square root of its gravity.

Considering the definition of density of light, we find the reason that, in testing gases of different candle power with a flat-flame burner, the light from the poorer gases suffers less by taking the flame edgewise than that from the richer gases. Sugg said (if I quote him correctly) that "with like burners, equal-sized flames are of the same candle-power;" and hence originated his illuminating power meter. But, laying aside the question of gravity, have we not found that, by varying the composition of the gas, we may vary the density of the light from the same sized flame, and thereby its candle-power? So that, if Sugg's meter is to be commercially correct, the composition of the gas must be kept within certain lines; that is, it will do for only the particular kind of gas for which it is adjusted.

In photometry, instead of saying that the intensity of the light

is inversely as the square of the distance, we may say that the quantity of light is in that ratio; for we admit that the quantity of light from two candles is greater than that from one, but is there really any greater intensity? There are only two photometers that are commercially practical for testing gases of various kinds—that of Bouguer, derived from Count Rumford's (the only one in which lights of various intensities of distinct colours may be accurately compared), and the bar photometer in its many forms and with its various accessories, as the refrigerator, air oven, reducing lens, &c. With any photometer we must have a standard of light; and we find quite a list of candidates, beginning with the candle (which, when properly made, still stands to the front for practical use) the carcel, the Keates and pentane lamps, the platinum strip, and various other ingenious devices, coming finally to the Methven slit. Most of these require more time and care in their use than their advantages are worth. The Methven slit, however, is a very clever and practical device; for, as the same size of slit is used for gases varying within wide limits, we find that in those limits the gravity and composition of the gas, as regards heating components, will not vary very materially. Hence the intensity of the light is within narrow bounds; and as the burner used for it is an Argand, it virtually presents to the slit one flame behind another—thus maintaining the effect of one flame of practically uniform density of light, so that the quantity of light which passes the slit is very constant when used with gas which is within the limits for which it is adjusted. One very great advantage of this form of standard is that, the same gas being used at both ends of the bar, the colours of the lights will be about the same, except only with the extreme variations in the burners.

It is obvious that no one burner will give fair results in testing the candle-power of all commercial illuminating gases; the chemical composition and specific gravity must both be respected. Knowing these, burners can be constructed, simple and cheap, to suit the requirements of any particular case. Our photometers measure not simply the intensity, but the quantity of light, from a given source; and although we may have the same quantity of light from a small source of high intensity as from a large source of low intensity, the illumination from them will be of a totally different character. Extreme variations in the distribution of light on the retina, strain and injure the eye. Everybody knows the effect of looking at a bright spot on comparatively dark ground, or a dark spot on a bright ground. The effect is very much lessened if there be no sharp outlines; for then the contrast is reduced, and it is found that for this reason the penumbra afforded by large lights count much in their favour.

This brings me to the subject of the diffusion of light, which is simply direct light reflected, refracted, and diffracted, suffering partial separation and recomposition, and thus being toned by the colour of the objects by which the diffusion is accomplished. While penumbra are produced by the difference in angle of direct light from different parts of the same source, diffused light is not limited to such definite angle, and therefore blends the shadow, often to a mere shade. The diffusion of the light will be greater as the source is larger; depending also upon the density of the light, and in proportion as it contains the more refrangible colours.

It has been stated that white light would not diffuse so well as yellow light. But as white light has all the components of the yellow, there can be no greater diffusion by the latter, except that it be greater in quantity, noting also that yellow is the colour which, of all others, taking them singly, produces the greatest sense of illumination in the eye.

Heretofore, it has been considered by gas makers that the question of illumination was a very complex one, that intensity and candle power were the same thing, and that colour was entirely independent of intensity; while density of light, though barely noticed, simply as a rich or thin light, has not been recognized. In gas lighting, the light being emitted by individual particles of carbon, the density of the light must be considered as distinguished from intensity.

By this we see why in compound Argands, as in the six-ring Douglass lighthouse burner, the efficiency of poor gases is enhanced so much more rapidly than that of rich gases; for the poorer the gas, the fewer will be the incandescing particles of carbon per unit of area—thus leaving space for the inner flame to send its light through, and add to that of the outer flame. With a rich gas there will be less opening through the outer flame, and the light of the inner flame would be proportionately obstructed, while both gases receive the benefit of the concentration of heat. With incandescing burners, many of the conditions are inverted; for now the gas is burned only for the greatest amount of heat that can be derived from it.

In the discussion on the paper, Mr. A. E. Boardman said he was glad that the writer supported the position he (Mr. Boardman) had always maintained, which was that large flame areas were the better for general illumination, even if of a little less intensity. He thought the explanation of the opinions expressed in favour of a mixture of water and coal gas, as compared with water gas alone, was simply that the mixture yielded a larger flame area. The slight tinge of yellow from the coal gas gave impression to the eye of greater luminosity. Mr. A. G. Glasgow said he understood intensity of light to mean the impression produced on the eye; and this was a different thing from illumination, in which the matter of colour came in. To find the practical value of a source of light as an illuminant, he would stand with his back to it, and look at surrounding objects. Yellow light would only show up yellow colours; and though it might appear brighter to the eye, what was really wanted was a white light containing all the colours of the spectrum, that would show up all the colours with equal effect.

Mr. Slater, replying to questions, said he had found by experiment that high-power water gas gave better candle power through a thin flat flame than from the ordinary "D" Argand. In considering the best burner to use, the gravity of the gas must be respected as much as the candle power. The heavier the gas, the higher should be the pressure; and with an increased quality, the size of the openings in the burner should be reduced. Some of the old-fashioned Argand burners, which gave a very poor duty with ordinary coal gas, answered well for water gas, simply because they produced a very thin flame. With regard to the effect of light on the eye, they might refer back to a paper on "The Relation of Light and Visual Perception," read by Mr. E. C. Jones at the meeting of the Association in 1887.

The last paper submitted to the meeting was on "The Theoretical Effect of Pre-heating Blast, Steam, and Oil in the Manufacture of Water Gas," by Mr. Rollin Norris. The author dealt with the subject in much detail; his conclusions being as follows: Steam has a very small heat-carrying capacity, and so its pre-heating will not pay unless the means employed are very simple. The maximum direct saving to be expected is from ¼ to ½ lb. of coal. The capacity of oil for absorbing heat is also small; but it must be pre-heated for economical candle-power results. The illuminating gases are a convenient source of heat for this purpose; and they give as high a temperature as the oil can well stand. Moreover, the vaporization of the oil in the heater makes its heat-absorbing power considerably greater than would at first sight appear. The advantages of pre-heating the blast are: (1) A saving of from 2 lbs. to 8 lbs. of coal per 1000 cubic feet, due to the heat actually returned to the apparatus by the hot air; (2) a saving of the heat usually lost in re-evaporating and decomposing the steam condensed out in the lower part of the fire during the run; (3) more complete combustion of the coal, and a smaller formation of cinder, involving less frequent cleaning of fires; (4) less time required for blowing up the heats; and consequent increase in daily capacity of set; (5) reduced waste of carbonic oxide. The margin for saving fuel in water-gas manufacture is no longer large; but it seems an efficient blast heater is the most promising factor in the problem.

After the reading of the paper, Mr. W. H. Pearson said he had tried an arrangement consisting of a series of pipes inserted in the take-off pipe, through which the oil was caused to travel on its way to the generator, in a direction opposite to that of the current of gas; and it was a failure. It was tried for a month by the makers, and then abandoned. There was no improvement in results, and the pipes became choked with carbon. The material used was a Canadian petroleum of about the same specific gravity as Lima crude oil—38° to 40° Baumé. Mr. C. R. Collins said the cause of the failure was overheating. They really had an excess of heat in the generator; and therefore the pre-heating not only showed no improvement in results, but also gave trouble from deposition of carbon. Mr. A. C. Humphreys said the pre-heater was not adapted for, nor was it designed for, the Canadian oil. Naphtha would not be a material suitable for the pre-heater. Mr. Shelton said he had worked two sets side by side, one of which was fitted with blast and oil heaters, and the other was not. The superheating secured a clean, bright fire down to the grate-bars, and these were not exposed to so much strain. The air was hot enough to melt solder; and he had no doubt whatever as to the possibility of improving the results by previously heating the blast and the oil. Mr. W. R. Addicks said he had used a steam superheater both for naphtha and for Lima crude oil, and found that it improved the results.

Attention was subsequently directed to the "Question-Box." In reply to an inquiry as to the results of furnishing gas by contract, Mr. W. S. Bowen said he had done some business in this direction as a means of meeting the competition of an electric light company. The price was put at a certain amount per month, regardless of the actual consumption; but the meters remained in position, and were read as usual, so that he knew the actual quantity used. In some cases he had found it necessary to increase the rate. Although some had taken advantage, on the whole the arrangement had proved satisfactory, as securing a class of customers that could not be reached in any other way. During the last five years he had sold about 9 million cubic feet of gas by contract; and the average price realized on the quantity used was 5s. 3d. per 1000 cubic feet, which was somewhat less than the regular price in his town. The contract system gave him more control over the burners, &c.; and he took care to keep these in order, and thus secured a good advertisement for his gas. The President said he had tried the plan, but found that in every case the consumption was increased from 30 to 50 per cent. beyond the agreed quantity; so he had to abandon it.

The second question, which was stated at some length, asked for information as to the effect of warm unpurified water gas

on relief holders. The inquirer had found that it corroded the plates to an extent far greater than anything he had experienced with coal gas, as his relief holder was in a very bad state, while another similar holder, built at the same time, but used for purified gas only, was in first-rate condition. Mr. Walton Clark said the gas should be properly condensed and scrubbed; otherwise sulphurous acid and steam might be carried into the holder. This would form appreciable quantities of sulphuric acid, which would condense on the plates, and corrode them. Sulphurous acid in the gas was the cause of the trouble; and this could be removed by scrubbing. Mr. F. B. Crowell remarked that he found his relief holder wear well.

Replying to a question as to the best way of using naphtha as an enricher, Mr. A. E. Boardman recommended making carburreted water gas, and mixing the same with the coal gas. Mr. Addicks said he had used naphtha in retorts, and obtained 80 cubic feet, or 3800 candle-feet per gallon, which was a poor result. Mr. J. Somerville had mixed oil and naphtha with dry slack coal, until the fluid was quite absorbed. A few shovelfuls of this mixture were used with each charge; and the result was satisfactory. Mr. I. Butterworth remarked that he used naphtha in ordinary coal-gas retorts. A 3-inch pipe conveyed the fluid to the back of the retort, and the front was packed with loose fire-brick. By proper attention to the heats and the supply of naphtha, no difficulty arose. He used one retort out of a bed of six—the others being charged with coal in the usual way; and the proportion was about half a gallon to 1000 cubic feet of gas made. The President, speaking after some experience, knew of nothing superior to Mr. Butterworth's plan.

The next question was: "Would it pay large gas companies to collect their accounts through the medium of a debt-collecting company?" Mr. G. A. Yuille said that at Chicago about 30 per cent. of the rental was paid through such a company, having offices in several parts of the district; and the plan was convenient, as saving the trouble of going to the gas office. Mr. G. F. Thompson said that at St. Louis about 17 per cent. of the accounts were paid to a collecting company. The fee for an account of less than £5 5s. was 2½d. There were about 30 places throughout the city where bills could be paid during the discount time; but after this had expired, all accounts must be settled at the office.

This concluded the technical business of the meeting.

DETERMINATION OF THE EFFICIENCY OF COAL.

By Dr. H. Bunte.

[Translated from the *Journal für Gasbeleuchtung.*]

(*Concluded from p.* 1137.)

I propose now to give a brief abstract of some experiments, on a small scale, upon which the conclusions previously set forth have been founded, and for which I am indebted to my assistant, Herr A. Bauer. To make these experiments, two sets of apparatus were used—one calorimeter invented by Herr F. Fischer, and a second invented by Berthelot, slightly modified by Alexejew. In both calorimeters fair samples of fuel, thoroughly pulverized, and about a gramme in weight, were ignited in a current of pure oxygen. The combustion chamber should be entirely surrounded by water. This water, as well as the solid parts of the calorimeter, is to take up the heat evolved, which is calculated from the specific heat of the different parts of the calorimeter, and the increase in temperature of the carefully-weighed quantity of water. This combustion of fuel in an atmosphere of oxygen does not by any means take place completely—a small part of it remaining as coke unburnt with the ashes, another minute portion escaping as carbon monoxide with the products of combustion. The heat of combustion of this inevitable refuse is to be added to the total quantity of heat evolved. As the escaping gases are cooled down to the temperature of the calorimeter, liquid (part of the steam produced in combustion) is condensed, contrary to ordinary ignition. As a rule, the heat of combustion found by means of a calorimeter is calculated on water in a liquid state as a product of combustion. Some chemists (as Scheurer-Kestner, Gottlieb, Alexejew, and others) did not make allowance for heat of evaporation of the volatilized part—a fact to which F. Fischer first called attention. It is more advisable to calculate the heat of combustion of fuel on steam of the "original temperature" as a product of combustion. In this case, as I have done in my experiments, the heat of evaporation of volatilized water is to be deducted from heat evolved. Fischer's calorimeter is shown in fig. 6. It consists of a combustion chamber made of silver, in which the fuel is burnt in a current of oxygen, which is washed by a solution of caustic potash for the purpose, dried, and passed through the glass tube *a*, which is affixed to the lid of the chamber by india-rubber tubing. From this chamber the oxygen is led along the platinum pipe *r* into the platinum crucible *z*, where ignition of the fuel takes place. About a gramme of coal is used for one experiment. The crucible is supported by a platinum ring *v*, which rests on a copper tripod *s*. The burnt gases escape through the platinum network *u* (which towards the end of the operation begins to glow, and prevents deposition of soot and formation of carbon monoxide) in a downward direction through the orifice *i*, reach the box *c*, and are drawn off at *b*. Until the escaping gases reach *b*, their temperature has been made to accord with that of the apparatus, as is shown by the thermometer. The vessel B is filled

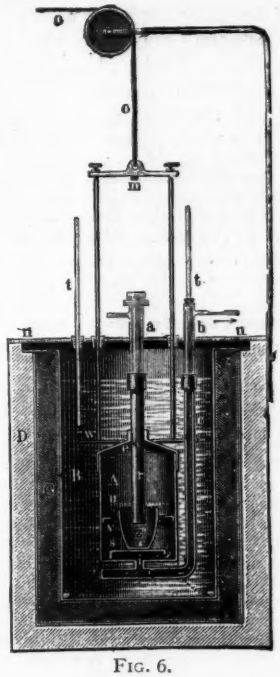


FIG. 6.

with about 1500 grammes of distilled water, which quantity should be carefully weighed. To avoid loss of heat by radiation, the outside of the apparatus is covered with wood D. The space C is filled with glass wool; or it may equally well remain empty. The top of the calorimeter is covered by a lid *n*, made of brass, silver-plated on both sides. Where the lid is divided, it contains two holes, to allow of the tubes *a* and *b* being passed in. A thermometer F, of the best description, is introduced through the lid and the tube *b*. The semi-lunar agitator *w* is suspended by a silk cord O, and can be moved in an up-and-down direction. The thermometer used was divided into 20ths of a degree centigrade. One centigrade covered a space of 4 mm. By aid of a magnifying-glass, 1-100th of a degree centigrade could be discerned. The determination of the heat-value of the calorimeter was performed, according to Fischer's direction, by introducing water of a moderately high temperature into the apparatus ready for use. The particulars of such an experiment are as follows:

Time in Minutes.	Temperature of Calorimeter in Deg. C.	Temperature of Water in Deg. C.	Difference.	Outside Temperature in Deg. C.
0	20·20	26·75		21·5
			0·10	
2	20·20	26·65	0·08	
4	20·20	26·57	0·04	
6	20·20	25·53	0·08	
8	20·20	26·45	0·08	
10	20·20	26·37		22·0
11½	Introduction of Water.			
12	25·88		0·03	
14	25·85		0·07	
16	25·78		0·05	
18	25·73		0·06	
20	25·67		0·05	22·0
22	25·62		0·06	
24	25·57			22·0

Before the water was introduced into the calorimeter, it cooled down in a minute, on an average, by (26·75 − 26·37) : 10 = 0·038° C. The moment it was put into the calorimeter, the temperature was 26·37 − 1·5 × 0·038 − 0·20° C. (correction of thermometer) = 26·11° C. As from the 16th minute, the temperature of the calorimeter filled with water decreased regularly by 0·05° to 0·06° in a space of two minutes, we are justified in supposing that the different metallic parts of the calorimeter had reached a similar temperature. This is 25·78° − 0·20° C. (correction of thermometer) = 25·58° C. From this time the regular decrease in temperature amounts to 0·21° C. within eight minutes—*i.e.*, 0·026° per minute. Had this temperature compensation taken place instantly, there would have been the same regular alteration in temperature (caused by the influence of the outside temperature of the calorimeter) in the space of time from the filling of the apparatus to the compensation of the temperature. This time is 16 − 11½ = 4½ minutes. Therefore 4½ × 0·026° = 0·117° C. should be added to the compensated temperature. The true compensated temperature is therefore 25·58 + 0·12 = 25·70° C.

Now we find that the water has lost in temperature 26·11 − 25·70 = 0·41°; and the calorimeter showed an increase in temperature of 25·70 − 20·20 = 5·50°. The two quantities of heat necessary to cause these differences in temperature are equal. The amount of water used is 1500 grammes. Suppose *x* to be the calorific value of the solid parts of the calorimeter, we find on calculation 0·41 × 1500 = 5·5 × *x*; *x* = 112 grammes of water. In two more experiments *x* was found to be 109 grammes. The average, therefore, is 110 grammes of water, or 110 calories.

The content of the measuring bottle used is:

One bottle containing 1 litre of water	=	998·78 grammes.
„ „ ½ „ „	=	499·75 „
Total		1498·53 grammes.

This quantity of water reduced to weight *in vacuo* is equal to 1500·1 grammes. The whole apparatus therefore requires for increasing its temperature by 1° C., 1500 + 110 = 1610 calories.

The calorific value of the solid parts of the apparatus can also be found by the following calculation: The calorific value of a substance is equal to the specific heat multiplied by the weight of the substance. In the case in question, we found as follows:

Weight of silver . . .	202·05 gr. × 0·0559	=	11·3 cal.
„ copper . . .	636·82 „ × 0·0933 }	=	101·1 „
„ brass . . .	446·33 „ × 0·0933 }		
„ platinum . .	19·21 „ × 0·0323	=	0·6 „
Part of thermometer dipped in water	about	=	0·5 „
	Calorific value =		113·5 cal.

For each experiment exactly 1 gramme of air-dried, finely-pulverized coal was employed. (Fischer proposes to use coal dried in a current of pure nitrogen at 110° C.) The products of combustion are weighed. The volatilized water was absorbed by two tubes filled with chloride of calcium; the condensed water was taken up from the apparatus by a current of dry air at 60° C., and absorbed as above. As a rule, too low a percentage of water is found, compared with the analysis, as traces of sulphuric acid, formed in combustion, retain some water obstinately. To absorb the carbonic acid, three Geissler apparatus charged with a solution of caustic potash, and three tubes filled with soda lime, were employed. The furnace gases, freed from water and carbonic acid, had to pass through a combustion-tube filled with oxide of copper, which was kept glowing to burn the hydrogen and carbon monoxide. As a rule, water (hydrogen) was never found, whereas the quantity of carbon dioxide formed by the oxidation of the carbon monoxide varied between 0·01 and 0·03 gramme. The experiments were made in a cool room; the blinds being drawn down to exclude the rays of lights.

On starting the experiment, the apparatus was balanced, and the combustion chamber charged and filled with oxygen. The temperature of the calorimeter was ascertained every second minute, and the agitator used. This done, a small piece of charcoal (0·5 to 2 milligrammes) was lighted and introduced through the tube *a*, and the time carefully noted. Thus the substance is easily ignited. The utmost speed of the current of oxygen is 1 to 1½ litres per minute. The operation of combustion is performed in from 10 to 15 minutes. During this time the temperature should be noted every minute. A few minutes after the extinction of the fuel, the maximum temperature of the apparatus is reached; the mercury rises to its highest level, then sinks rapidly, and afterwards gradually. By this time the observations are recorded every two minutes. To complete the experiment, air is drawn through the apparatus, the constituent portions of it taken apart, and the tubes containing carbonic acid and absorbed water weighed. In the crucible there remains a little coke, the quantity of which is ascertained by igniting the combustible matters contained in it. This residuum of coke, on an average, amounts to 10 milligrammes. With lignite it is very minute. This loss in weight cannot be considered to be pure carbon; and it is therefore calculated to be equal to 8000 calories per gramme. The carbonic oxide in the escaping gases is burnt and weighed as carbon dioxide, each milligramme of the latter being calculated to be equal to 1·529 calories ($2403 \times \frac{28}{44} : 1000$). The hydrogen in the furnace gases is burnt to water; one milligramme of the latter being equal to 3·2 calories—28,800 : (9 × 1000). By making up the figures for the total carbon dioxide, the percentage will be found too high compared with that found by elementary analysis. This is accounted for by sulphur dioxide being absorbed along with the carbonic acid. The heat of evaporation of the condensed water (calculated from the difference between the total water of combustion and the volatilized water) is, as Regnault has shown, for one gramme of water of the temperature $t°$ transformed into steam of $t°$ C. = 606·5 − 0·695t calories. This is for 10° C., for instance, 600 calories; for 20° C., 593 calories.

If, from the time of lighting the fuel until compensation of temperature takes place, the apparatus should neither receive heat from without nor lose any, by multiplying the increase in temperature by the calorific value of the apparatus, the total heat evolved by the substance under experiment would be found, after having made allowance for the coke and gases unburnt and the condensation of steam. In reality, however, the apparatus will be cooled down or heated up, as the case may be; and this circumstance requires a correction. Rumford's proposition seems to be unreliable. He says that when the original temperature is as much below the outside temperature as the assumed final temperature will be above it, the quantities of heat gained or lost during the time of the experiment may compensate each other, provided the experiment is performed regularly. However right this supposition may be, a certain quantity of heat is sure to be lost while compensation of temperature takes place. Most chemists are therefore using a formula for correction which has been proposed by Regnault and Pfaundler. It is based on the supposition that the heat given up by the apparatus increases proportionally with the increase in temperature. We will divide each experiment into three parts, and call the first part the "primary experiment;" the second, the "chief experiment;" and the third, the "final experiment." Let the loss of heat per minute in the primary experiment be represented by v, and the average temperature t; the loss of heat per minute of the final experiment v^1, and its average temperature t^1. Then the loss of heat within the n^{th} minute of the chief experiment will be v_n, and the average temperature t_n—

$$v_n = v + \frac{(v^1 - v)\ (t_n - t)}{t^1 - t} \qquad (1)$$

Let the original temperature of the first minute of the chief experiment be θ_0, that of the second θ_1, and the final temperature θ_n; then the sum of the average temperatures of the minutes of experiment will be—

$$\frac{\theta_0 + \theta_1}{2} + \frac{\theta_1 + \theta_2}{2} \ldots + \frac{\theta_{n-1} + \theta_n}{2} \text{ or } \theta_1 + \theta_2 \ldots + \theta_{n-1} + \frac{\theta_0 + \theta_n}{2},$$

and the total correction C—

$$C = vn + \left(\theta_1 + \theta_2 + \ldots \theta_{n-1} + \frac{\theta_0 + \theta_n}{2} - nt\right)\frac{v^1 - v}{t^1 - t} \qquad (2)$$

Instead of using this complicated formula, we get the same result by calculating according to the following one: Suppose $t = \theta_0$ and $t^1 = \theta_n$. Moreover, the average temperature of the experiment is $= (t + t^1) \div 2$, provided the increase in temperature is regular. We conclude therefrom—

$$vn + \frac{v^1 - v}{t^1 - t} \cdot n\left(\frac{t + t^1}{2} - t\right) \text{ or } vn + n.\ \frac{(v^1 - v)\ (t^1 - t)}{(t^1 - t).2}$$

$$C = n.\ \frac{v^1 + v}{2}$$

The above supposition of regular increase in temperature has no application to the time of the compensation of temperature. Therefore n expresses only the duration of the experiment, or the actual combustion. During the time of compensation of a duration of n^1, the temperature decreases by $n^1 v^1$ degrees C. To find out the real increase in temperature, we therefore have to add to the difference between the original and the final temperature—

$$n.\frac{v + v^1}{2} + n^1 v^1 \text{ degrees Centigrades.} \quad (3)$$

I propose now to give the figures arrived at in an experiment made on April 13, 1890, with Fischer's calorimeter, on Saar coal from the Luisenthal Mine:—

	Grammes.	
Coal used	1·0000	
Residue	0·0705	
Ash	0·0620	
Coke residue	0·0085 × 8 =	+ 68 cal.
Gaseous water	0·1001 gr.	
Liquid water	0·4015 „	
	0·5016	
CO_2 directly formed	2·625	
CO_2 out of CO *	0·0276	27·6 × 1·529 = + 42·2 cal.
Carbon found (including coke) . . .	0·7320 = 73·2 p. ct.	
Weight of piece of charcoal, 1 mg. =	8· cal.	
Oxygen used	7 litres.	
Water found by elementary analysis .	0·4682	
Gaseous water	0·1001	
Difference = liquid water =	0·3681	

0·3681 × 597 cal.† = 219·8 cal. produced by condensation of water.

	Time in Minutes.	Temperature of Calorimeter in Deg. C.	Difference.	Temperature of Furnace Gases in Deg. C.	Outside Temperature in Deg. C.
Primary Experiment.	0	11·510			
	2	11·520	+ 0·010		
	4	11·530	+ 0·010	.. —	.. 14·0
	6	11·540	+ 0·010		
	6′ 30″	Kindled		.. 12·0	.. 14·5
Chief Experiment.	7	11·600	+ 0·060		
	8	11·750	+ 0·150		
	9	12·100	+ 0·250		
	10	12·800	+ 0·700		
	11	13·600	+ 0·400	.. 12·5	.. 14·5
	12	14·300	+ 0·700		
	13	14·800	+ 0·500	.. 13·5	
	14	15·300	+ 0·500	.. 14·0	
	15	15·550	+ 0·250		
	15′ 30″	Extinguished		.. 15·0	.. 14·5
Final Experiment.	16	15·770	+ 0·220		
	17	15·790	+ 0·020		
	18	15·790	—		
	20	15·750	− 0·040	.. —	.. 14·5
	22	15·725	− 0·025		
	24	15·690	− 0·035		
	26	15·660	− 0·030		
	28	15·630	− 0·030	.. —	.. 14·5
	30	15·605	− 0·025		

To avoid the formation of soot, combustion was performed very slowly.

CALCULATION.

Corrections for the Cooling of the Calorimeter.

Increase in temperature during primary experiment, 0·03° in 6 min.
$v = -0·005$.

Decrease in temperature during final experiment, 0·145° in 10 min.
$v^1 = 0·0145$.

* There was no hydrogen present in the escaping gases.
† Heat of evaporation of water at 14° C.

Additional Corrections.

Duration up to time of kindling, 30 sec. . $.0'5 \times -0.005 = -0'0025°$ C.

Duration of combustion (n), 9 min. $= 9 \times \frac{0'0145 - 0'005}{2} = +0'0428°$ C.

Duration of compensation of temperature (n^1), 4 min. 30 sec. $= 4'5 \times 0'0145 = +0'0653°$ C.

Total correction $C = +0'1056°$ C.

According to the Regnault-Pfaundler formula, this correction is found to be $+0'1048°$ C.

Heat Evolved.

	Deg. C.
Temperature of compensation of heat	15'750
Correction of thermometer	− 0'031
Corrected temperature of compensation of heat	15'719
Original temperature	11'540
Correction of thermometer	+ 0'056
Corrected original temperature	11'596
Increase in temperature	4'123
Correction for cooling of the calorimeter	+ 0'106
Actual increase in temperature	4.229
Heat evolved	4'229 × 1610 = 6808'7 cal.

Additional Corrections.

Heat not evolved—	
From carbon monoxide	+ 42'2 cal.
From residue unburnt	+ 68'0 „
Heat to be abstracted—	
Combustion of piece of charcoal	− 8'0 „
Condensation of steam	−219'8 „
Total	6691'1 cal.

One gramme of this coal yields, by combustion to carbonic acid and water in a vaporous state, of an equal temperature, 6691 gramme-calories; one kilogramme, as many kilogramme-calories (units of heat). Two additional experiments showed 6680 and 6618 calories. The average is 6663 calories. The heat of combustion, calculated by the Dulong formula and elementary analysis of this coal, was found to be 6646 calories—*i.e.*, 19 calories, or 0'3 per cent. less, which is a difference that can be wholly neglected.

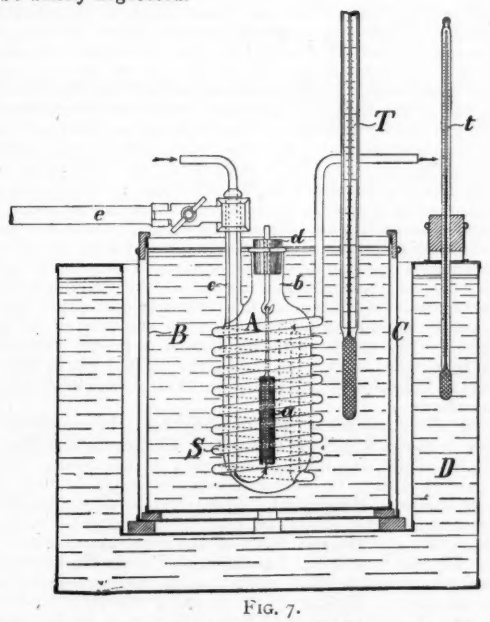


FIG. 7.

Some of the experiments were made by means of another apparatus, the construction of which was suggested by Berthelot, and improved by Alexejew. This improved form is shown in figs. 7 and 8. The combustion chamber A is made of glass, which greatly facilitates observation of the combustion of the fuel. Its capacity is about 300 cubic centimetres, and its weight something like 100 grammes. On one side of this combustion chamber there is a tubule *c*, through which oxygen is introduced. The chamber is charged by suspending in it a cylinder *a*, made of fine platinum net, containing the pulverized fuel. The chamber is closed by a stopper *d*, which is to carry the network cylinder. The escaping gases have to pass a glass tube T, coiled round the chamber A, where they are cooled down to the temperature of the surrounding liquid. The brass cylinder B is lined with tin foil, and contains about 2½ litres of water, which is carefully weighed. The agitator R is to surround the combustion chamber, and distribute the heat absorbed by the water in B. Around B there is a second brass cylinder C, well isolated by pieces of cork. The whole is placed in a third vessel D, which contains a large quantity of water (about 6 kilos.). This quantity of water changes its temperature but slowly, on account of its great heat capacity, and makes the loss of heat by radiation and conduction regular and determinable. The thermometer T should be of the best description, as the quantity of water in the calorimeter is large, and the increase in temperature therefore very small. The author was using a thermometer

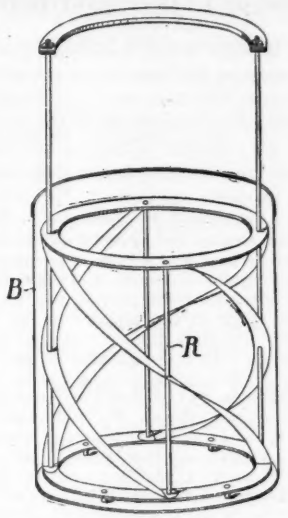


FIG. 8.

which contained about 30 grammes of mercury, and was divided into hundredths of a centigrade, one centigrade covering a space of 40 millimetres. By the aid of a magnifying glass, 1-100th of a degree Centigrade could be estimated. The calorific value of the apparatus was calculated from the weights of its different parts made of glass, or any metal.

This apparatus is used in the same way as Fischer's. To kindle the fuel under experiment, the stopper is taken off, and a piece of glowing charcoal introduced into the combustion chamber. In the experiment, the same operations are performed as described above. The coals are burnt more completely in this apparatus than by using that of Fischer; but we could never consume the whole of it down to ash, as Alexejew asserts. The residue was ignited, and the loss in weight calculated as coke. The quantity of condensed water was ascertained by carefully drying the combustion chamber from without, and weighing it. Deducting the weight of the glass, we find the quantity of condensed water. Combustion free from soot can only be obtained by properly proportioning the current of oxygen. The glass tube supplying oxygen should reach the bottom of the combustion chamber. The nature of the network cylinder *a* does not allow the use of finely pulverized coal, which was avoided by grinding it, and making it into small briquettes by applying a high pressure. There was only one sort of coal—viz., Boghead—which could not be treated in this way. Berthelot's apparatus is very handy; but it requires a very good thermometer—the increase in temperature for one gramme of coal being not more than about 3° C.

As shown by the tables (see *ante* pp. 1135-6) the experiments made by using Fischer's calorimeter and that of Berthelot accord to a degree that is highly satisfactory for technical purposes, and lead to the conclusion that the Dulong formula may be used for calculating the heat of combustion or the calorific power of coal from elementary analysis.

Mr. Richard Inns, J.P., of Barnsley, died last Tuesday, at the ripe age of 82 years. The deceased gentleman was a Director, and for a long time Chairman of the Barnsley Gas Company; but he resigned the latter position a few years ago.

Philadelphia Water Supply.—Among the new plans for improving the water supply of Philadelphia, is one which contemplates taking about 254 million gallons a day from the Schuylkill River, near Norristown, and conducting it through pipes and a tunnel to the city pumping-stations at Flat Rock and Fairmount Dams. It is claimed that from Norristown to Phœnixville, a distance of 12 miles, there are only a few farmhouses along the river; and from Phœnixville west for 12 miles, only the small boroughs of Reyersford and Spring City. So that pollution of the water for about 24 miles is reduced to a minimum. The river flows over a sandstone formation for this distance, and is probably subjected to self-purification to some extent. Along this part of the course there is a series of pools, containing in all some 4500 million gallons, which are controlled by the Schuylkill Navigation Company. The minimum flow of the river at Norristown is estimated at 220 million gallons per day; so that in seasons of drought, it is claimed that this source of supply would furnish some 300 million gallons daily. It is proposed to take the water at Norristown into two steel pipes, 8'6 feet in diameter, in which it will flow to Conshohocken. There it will enter a tunnel 7'7 miles long, and flow to West Park, opposite East Park reservoir. From West Park it will be carried across the river on a bridge; and finally be delivered at the Fairmount pumping-station. The cost of the work, including land and water rights, tunnel, conduits, and bridge, is estimated at £1,300,650. The sums required for other plans range from £3,100,000 to £3,920,000.

THE RELATIONS OF A GAS COMPANY TO ITS CONSUMERS.

At a recent Meeting of the Society of Gas Lighting (New York), a paper bearing the above title was read by Mr. A. B. SLATER, in which he criticized the communication on "Meter-Rents" submitted to the members of the American Gaslight Association by Mr. Walton Clark, on the occasion of their assembly in New York last October, and given in the JOURNAL for the 1st inst. (p. 990).

The author commenced by taking the four propositions assumed by Mr. Clark to be generally admitted—viz., (1) A gas company ordinarily has, and it is to the general interest that it should have, a regulated monopoly of the right to open streets and occupy the subsoil for the purposes of gas supply; (2) its rights have their origin in the citizens of the State; (3) these rights involve peculiar obligations to the public granting them; and (4) in common with railroads and other corporations performing a public service, a gas company is under obligations to make no distinction in its treatment of individuals served by it—and commenting upon them. He said he could hardly agree with the first, as, so far as his knowledge went, very few companies in America have any monopoly of the right to use the streets; but he thought a regulated monopoly therein should be conferred. To the second and third propositions he agreed; but as to the fourth, while it was theoretically and substantially true, he thought it was open to discussion in its application, in the sense that gas companies should adopt it in their relations to their consumers. The subject opened up a wide field for discussion, as it involved the scaling of prices for different quantities of gas purchased or used by each consumer, the discounts for prompt payment, and alteration in price for gas used in various ways, such as illumination, domestic, or mechanical purposes. Mr. Slater then proceeded as follows:

Years of experience in the manufacture of illuminating gas, together with improved apparatus, machinery, and processes, to say nothing of competition with kerosene oil and the electric light, have all had more or less influence in changing and improving the management and policy of gas companies in their relations to their consumers, and react favourably to the success and prosperity of the companies. After an experience covering a period of more than 38 years, I am clearly of opinion that there should be but one price for the gas consumed by all classes of consumers; but, from local circumstances and conditions, which may, perhaps, have obtained for years, a small rebate may be made at the end of the calendar year to large consumers—say, those consuming a million cubic feet a year.

There is no real or valid reason why the municipality should pay a less rate per 1000 cubic feet than other consumers. Certainly, street lighting is the least satisfactory of any portion of the business, as the quantity of gas consumed is not measured by a meter, but estimated from the nominal size of the burners, and the average length of time they are burning; or, where they are kept alight all night, a stated price per lamp is charged. Again, the expense of street lighting is paid for by the taxpayers; and just in proportion as the price is reduced to the city, that charged to the general consumer must be more. At the same time, the directors of a gas company may, from motives of policy, deem it best to make a small concession to the city for its gas. The grand underlying principle in the management of a gas company in its relations to its consumers, is exactly the same that all successful tradesmen apply to their business, which is: Do everything that is proper and consistent, and please your customers if you can. How long would a grocer keep his customers, if he added to his bill of goods sent out a charge for delivery, upon the plea that it cost him more to deliver the goods to the customer than when he sold them at his own store? Yet, in the same sense that Mr. Clark would charge meter-rent, such statement would be quite true. Although there is scarcely any relation between the scales and measures of a grocer and the meters which must be furnished for every customer of a gas company, the argument is often brought up by the consumer that a grocer has just as much right to charge, and there is just as much sense in the grocer charging, his customers for the use of his scales and measures, as there is for the gas company to charge the consumers for rent of their meters.

The discount system has little to commend it, and much to condemn it. The only reason for the system at all is to offer an inducement to the consumer to pay his bill promptly. The net price is all the gas company want for their gas; and a customer who intends to pay his bill will generally pay it within a reasonable time. If he is of the class of those who intend to postpone payment as long as possible, the sooner he is notified that it must be made or the gas supply discontinued, the better. If he is of that class who do not intend to pay at all, the sooner the supply is stopped, the less the gas company will lose; and it is for the interest of the company to let the electric light people have him. Again, the discount rule is no rule at all, unless it is lived up to strictly. A customer who consumes a large quantity of gas per month, and neglects to pay his bill within the discount time (whether from carelessness or oversight makes no difference), should not be allowed discount. If the rule is ignored in his case, another consumer who neglects, for perhaps a day or two over the discount time, to pay his bill, has just as good a claim to, and as good a right to demand, consideration as the other one; and if it is allowed, the rule amounts to nothing. If it is not allowed, bad feeling is engendered; and the effect of enforcing such a rule is to create enemies to the gas company.

Good judgment dictates that you should be frank with your customers, sell gas at as low a price as you can afford (to give the stockholders a reasonable return for their money invested), make out the bill at a stated price for all, and impose no petty charges for meter-rent, attendance for bad lights, or complaints. When we make different prices for various quantities of gas consumed—that is, lessening the price as the quantity of gas consumed in a stated time increases—then the cry is that we are favouring the rich as against the poor. When discounts are allowed, or different prices charged, the clerical work is increased, and the liability to errors also. Questions by consumers relative to bills are multiplied, explanations demanded, and vexations and worriment of both consumers and collectors or clerks are greater; whereas, with one general price, almost the only question that arises is the amount of the bill.

Radical changes should be well considered, and adopted with caution. Customs which have prevailed for a long time cannot always be interfered with successfully or advantageously. It is not good policy to have a set of cast-iron "rules and regulations," and enforce them in an arbitrary manner. While there should be system and order in conducting a large business, when it is a corporation doing business with the public, like a gas company, especially as it is what the people are pleased to style a "monopoly," the wisdom and good judgment of the manager can be exercised to better advantage to the company than a set of fixed rules and regulations which must always be rigidly enforced.

The management of gas companies should be improved upon year by year, as we know is done in all other kinds of business. It is shown in improvement in apparatus for manufacture, in selling a better quality of gas at a cheaper rate, and in being more liberal in our dealings with the public. The custom of charging the consumer for a portion of the service-pipe, for fixing the meter, or for the rent of the meter, even in the case of a small consumption of gas—all these petty things should be abolished. The revenue from all these sources is of comparatively small amount at the end of the year, the work is simplified, and further inducements are offered the people to take gas in place of other means of illumination, as well as for domestic and mechanical purposes. Scientific nicety, mechanical principles, and algebraic formulæ can be employed advantageously by the constructing engineer; but they can hardly aid the manager of a gas company's business in his endeavours to improve upon the policy of the company in its relations to its consumers. The manager of a gas company which has a capital representing money actually and honestly expended, is not hampered from over-capitalization if good judgment has been exercised in the design and construction of the works. The ratio of capital per 1000 feet of gas sold is not excessive; the earning capacity of the business will allow of a reasonably low price for gas sold; and he need have no fears that the abolition of the petty charges already mentioned will disturb a proper relation of capital to output—on the contrary, the probability is that the increase in the sales of gas will more than compensate for any such tendency.

If the directors of a gas company have inaugurated and steadily pursued a policy of making all the money they can out of the public, and have, to a greater or less extent, watered their capital, it must be considered an unwise policy, even from a purely business standpoint. The items of depreciation and wear and tear should always be kept in mind and provided for year by year; and the real value of the plant at any given time is that for which it could be duplicated to do the same work, without any regard to what it has cost, as appears by the books of the company. Whenever the nominal capital is very much more than the actual value of the plant, it is in my judgment a departure from sound business management and true policy for any company whose very existence is derived from the people, whose business is circumscribed in its limits, and where a mutuality of interests should never be lost sight of. Where the capital is less than the actual value of the plant, then the company will be serving their own interest if the price of gas is made correspondingly low, as the net profit per 1000 feet of gas sold to pay a reasonable dividend must be less, and also because such difference in value must have come from the consumers, who should, in turn, have the benefit of it in the price they pay for gas.

The question of whether the consumers of gas can be best served by private or *quasi*-public corporations or by the municipal ownership of gas-works, has been attracting considerable attention of late. I think that it is outside the province of a municipality to engage in any kind of manufacturing business. It is an unwarranted interference with private enterprise, which should be governed by such wise, proper, and reasonable statutory regulations as experience dictates to be necessary to protect both the stockholders of the company and the public, including a limitation of capital and profits. In the case of municipal ownership, rigid rules and regulations are enforced in what the consumer considers to be an arbitrary manner. Where private ownership of gas undertakings prevails, competition with kerosene oil and electricity conduce to less stringent

rules and regulations being made, and more consideration used in enforcing them. The authorities of a town or city cannot build gas-works, but are obliged to employ construction companies to do it for them, as a private corporation does. In the matter of management, the same course must be taken—that is, a competent engineer or manager must be employed; and if the general control is vested in a committee of the city council, or the commissioner of public works, in either case they have little or no actual knowledge of the business, and are likely to be changed every year. How is the consumer of gas going to be benefited by such management? One writer says that in the City of Philadelphia, where the gas-works have been owned and under municipal control for years, while the consumers nominally pay $1·50 per 1000 cubic feet for gas, they really pay but $1, as the 50c. go into the city treasury; but he fails to explain what reason or justice there is in taxing the gas consumers 50c. per 1000 feet for the gas they consume, to help to pay the taxes of other people who are not consumers of gas.

A certain sum of money is required to be invested in gas-works, gasholders, land for the plant, mains, service-pipes, meters, connections, &c., all of sufficient capacity to supply a town or city with gas. The investment should be made with a practical knowledge of the business, and with good ability and judgment. The promoters of the enterprise are entitled to a fair return for the use of their money, which, when once invested in such an undertaking, cannot be used for any other purpose. It costs something to make and distribute gas over a large and extended territory, notwithstanding the ever-present tyro in chemistry and invention who has discovered a "new process," by which he can make for nothing a better gas than can be produced by any other process. The true policy is to pay the stockholders of a company a reasonable return for the use of their money, keep the property good, and sell gas at a price that will do this and simply pay the expense of running the business. A company doing this can always satisfy reasonable men, whether they are members of a city council or consumers of gas generally, that the business is carried on with due regard to the rights of the people as well as the stockholders of the company; and they will not find their customers very much dissatisfied if no meter-rent or other little charges are made with a view of trying to make uniform the profit per unit of service rendered.

The Lighting and Ventilation of the Harris Institute at Preston.—For several sessions past great complaints have been made by the pupils and teachers, and also by the superintendents of the Government examinations, as to the bad ventilation of the rooms of the Harris Institute at Preston. The rooms (in which classes are held in the evening) are brilliantly lighted; and with the old arrangement of jets, the chambers became unbearably close. The Council decided to have the whole premises ventilated thoroughly and efficiently, and took into consultation Mr. Henry Green, the Manager of the Preston Gas Company. He advised that Messrs. W. Sugg and Co. should be asked to give an estimate of the probable cost, and particulars as to their system of ventilation. The result was that Messrs. Sugg and Co. were commissioned to fit up the place with their patent vertical flat-flame ventilating gas lights. This they have done; and the change has proved most satisfactory. The number of pupils at the Institute has increased; and the ventilation of the rooms is now all that can be desired, but (what is more gratifying to the Council) the consumption of gas is less than under the old system.

Diverting a Flow of Water.—A discussion is now going on in Wyoming, says the *Engineering Record*, of New York, as to the right of Colorado to divert a portion of the flow of the Big Laramee River, for the purposes of irrigation, in the latter State. It is claimed that though the source of this stream is in Colorado, its flow is through Wyoming, and the diversion of any part of the water would prove an injury to it. When the question of increasing the water supply of New York was being actively discussed some eight years ago, and a proposition was made by private parties to deliver to New York water from the Ramapo region, which is in New York State, on the west side of the Hudson River, by means of pipes across that river, New Jersey took steps to prevent such a diversion of the Ramapo water, because, as in the Wyoming case, the natural flow was through the State. A Commission was created to resist, whenever occasion arose, any such attempt, by appeal to the United States Supreme Court if necessary. The result of such an appeal, it seems reasonable to suppose, would be in favour of the contesting State; though in the case cited, the matter was dropped and the issue avoided.

Staines and Egham District Gas Company, Limited.—The annual general meeting of this Company was held on the 18th inst.—Mr. W Weller presiding. In opening the proceedings, the Chairman congratulated the shareholders upon the prosperous condition of the Company, and the result of the past year's business. The balance-sheet presented showed that the profits were less than in the preceding year; but this was accounted for by the fact that coals were higher in price, and that the reduction of 6d. per 1000 cubic feet in the price of gas extended over the whole of the year, while it only affected six months of the previous period; and in addition to this, the Directors had erected a steam-crane for unloading coals from the barges, a considerable part of the expense of which was charged to the current account. The whole of the plant was reported to be in thorough working order. In proposing the dividend recommended, the Chairman said he thought it must be most satisfactory to the shareholders that they were able to pay the full statutory 12½ per cent., notwithstanding the reduction in the price of gas to 3s. 6d. per 1000 cubic feet. The three retiring Directors having been unanimously re-elected, votes of thanks were passed to Mr. J. Harris, as Chairman of the Directors during the past year; to the Secretary (Mr. Engall); and also to the Manager (Mr. T. Webb), whose salary has been raised by £50 per annum.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

The Proposed Investigation into the Standards of Light.

Sir,—As we in the provinces have an interest in photometry scarcely second to that of the Metropolitan Companies, I should like to suggest to the Committee now being, or already formed, one other direction in which a reform appears to be needed. This is in the use of the standard burner, the rate of consumption in which ought not, as at present, to be fixed, but should be variable in accordance with a rule to be defined; the object being to obtain, with different qualities of gas, a much nearer approach to the maximum efficiency of the burner than is possible with the prescribed rate. The desirability—in fact, the justice—of some such alteration was admitted during the discussion upon Mr. John Methven's paper on "Photometry," at the meeting of the Southern District Association in 1890, when Mr. Vernon Harcourt is reported to have said: "With the 'London' Argand, if the consumption were reduced by one-fifth, the yield of light sank to about one-half; and, from the same causes, if the actual quality of the gas were somewhat low, the yield of light with a consumption limited to 5 cubic feet per hour was greatly reduced. Thus any deficiency in the gas was much exaggerated. A more just estimate would be formed by setting the light of the burner equal to 16 candles, and observing the rate of consumption. This should not be lost sight of in any future legislation touching the mode of testing the illuminating power of gas."

Mr. Harcourt's proposal is satisfactory so far as it goes, and as admitting the principle that the gas should be tested under uniform conditions. I am not, however, sure that it would be found very convenient in practice; and it does not seem to me to completely meet the case. More than one, and possibly three or four series of observations might have to be made to arrive at the 16 candles illumination, having regard to the necessary corrections and consumption of candles, temperature, and pressure. The skilled operator would probably seek to shorten his task by turning up the gas so as to get, according to his experience, the required amount of light; but then the height of flame is not a certain guide to illuminating power, because it varies according to the composition of the gas.

What I propose is, that in all cases the gas should be turned on until it fairly fills the chimney, or (say) to within half an inch of the top. This would ensure its being uniformly tested under the conditions most favourable to the development of light by the particular burner employed. For 16-candle gas, the chimney might very well be somewhat less than 6 inches in height.

It may be objected that such a rule would operate in favour of the Companies. So also, it may be replied, did the adoption of the "London" Argand as the testing burner without alteration of the parliamentary standard; and if the then Gas Referees were right in their contention—endorsed by twenty years' general acquiescence—that the Companies were entitled to have their gas tested by the best known burner, surely it is only reasonable to require that the burner be used to proper advantage, and in an intelligent and scientific manner.

Apart from this question as between consumer and producer, there are other reasons for desiring an alteration in the present method of employing the burner. It is certain that the 5 feet rate gives rise to much misconception when the merits of any particular method or process are under discussion. We hear, for instance, of a process by which 14-candle gas can be brought up to 17 candles, showing an improvement of 3 candles; but some one else tries it with a richer gas—say, 16 or 17 candles—without obtaining anything like the same result. It is evident that the improvement shown by the original experiment must have been largely due to the burner, which, when the prescribed rate of consumption is observed, favours the richer gas. Had the tests been made instead with the chimney fairly full of flame, the actual increase due to enrichment would have been ascertained; and subsequent disappointment and misunderstanding avoided. This, however, is quite a mild illustration of the misleading character of tests, carried out at the prescribed rate, which I have been obliged to discard as altogether unsuitable for exact determinations or investigations involving comparisons.

CHAS. HUNT.

Birmingham, Dec. 26, 1891.

Sir,—The point raised by Mr. Leicester Greville in his letter published in the last issue of the JOURNAL—viz., that any new standard to be adopted should be exactly equivalent to the old one—certainly deserves primary consideration. If the present standard were a non-varying one, such agreement could be obtained without much difficulty; but its variations are great, and attributable to many causes—perhaps the most important being the length of time allowed to elapse, after the candles have been lighted, before a test is made. The shape of the wick in a great measure depends upon this.

It has lately been shown by Mr. Young that candles give fairly uniform results if allowed to burn 10 to 15 minutes only before making a test, and then extinguished and allowed to get cold before being used to make a second. Mr. Grafton, however, has proved that equally uniform results may be obtained if the candles be allowed to burn for a longer period; and that such results do not agree with those obtained by allowing the candles to burn for but 10 to 15 minutes.

Now, it could never have been intended, when the standard candle was authorized, that the light developed during any particular period of its burning should be regarded as the standard; and I submit that, to obtain a new standard agreeing with the old one, the light of the candle during the whole period of its burning should be taken. This could be done in some such photometer as that proposed by Mr. Greville. The candles, having been lighted, should not be extinguished until consumed as far as possible, and observations ought to be taken during the whole period.

E. LLEWELLYN PRYCE.

Windsor Street Gas-Works, Birmingham, Dec. 26, 1891.

The Ward Defence Fund.

Sir,—Allow me to contradict a misstatement in reference to myself in last week's issue of the JOURNAL. Neither the *Trade Unionist* nor any other paper had any authority from me to make such a statement.

Neither publicly nor privately have I ever said so; neither have I ever appealed for funds to anyone outside the membership of this Union. The case being *sub judice*, I will not refer to it—that will all come in good time; but I cannot help noticing the venom of the writer of the article. I generally treat effusions of this sort with the contempt they deserve; but I could not allow this erroneous statement to go forth to the world uncontradicted. The Gas Workers' Union and its officers seem to be an eyesore to the leader-writers of the JOURNAL. "The Gas Workers' Union is fast killing the goose that lays the golden eggs," says one of those gifted scribes. I suppose he attributes to the Union the cause of the rise in the price of gas. If he does that, it proves he knows very little about the matter he writes of. What a cry there would be if it was a demand on the part of the Union for a rise of wages for their members! If companies think fit to expend thousands of pounds on experiments which turn out complete failures, why should the Union be held responsible? This is a question for the gas consumers to take up, not for the Union, who can always manage its own affairs without the interference of those luminaries of No. 11, Bolt Court.

Dec. 23, 1891. W. H. WARD,
Assistant-Secretary, Gas Workers', &c., Union.

[We have nothing to say to Mr. Ward, especially as we do not clearly understand what it is that he is so anxious to deny.—ED. J. G. L.]

The Recent Press Demonstration of the Welsbach Light.

SIR,—We have read the article in your issue of the 22nd inst., headed "Welsbach Redivivus," and lose no time in correcting certain inaccuracies therein.

You state that you were not invited to the demonstration at which the Press attended. We most emphatically beg to assure you that you were invited—that not only was an invitation sent to you, but a reminder was sent two days before the meeting; and we fail to understand how you could have become aware of the fact that such a meeting was to be held had you not received the invitation, inasmuch as the meeting was quite private, and had not been advertised. If the asperity of your remarks be due to any feeling of injury at our supposed neglect, we can only say that, while regretting the incident, we cannot but think that a journal such as yours should not allow any petty personal feelings to influence its judgment upon the merits of any system.

We had no desire, as you insinuate, to unduly influence the representatives of the Press who attended our meeting, though naturally we desired that the system which we were demonstrating should receive notice. We only asked, and wished, for a candid opinion and fair criticism on what we had to show; and our opinion of the English Press is so far higher than that held by yourself, that we do not believe it is open to the sort of influence suggested by you. You are also mistaken in saying that our General Manager said nothing respecting the "tribulations" through which the Company had passed. He most certainly did refer to these, and at some length explained them.

We notice with pleasure that, notwithstanding your prejudice, you do not dare to deny our claim that we obtain a light of 60-candle power with a consumption of 3 cubic feet of gas an hour; but you put forward this claim in such a manner that it insinuates a doubt. We really should have thought that you would have the courage of your opinions, whatever they might be, and would either have satisfied yourself that our claim was not to be substantiated, or would have had the fairness to acknowledge its accuracy.

We really do not know what notes your representative may or may not have taken, or from what source you obtained your report; but what our Manager did say was that the gas companies were opposed to, and did not encourage, a system in which a reduced consumption of gas was the leading feature. He further stated that in the future it was very probable that gas companies would introduce water gas or fuel gas; and that these would produce as good results, with our system, as the present coal gas. Our Manager's opinion as to the position taken up by gas companies with respect to our light, was based upon our previous experience, which has been that they have not cared to bring our system to the notice of their customers; and we have every right to form our own conclusions as to the reasons which may have prompted them.

As to the employment of fuel or water gas in future, we are not alone in the opinions we have expressed; and the fact that they do not coincide with your own does not warrant the employment of language such as you adopt. Such expressions as "tissue of misrepresentations" and "pernicious nonsense," in our opinion, exceed the conventional courtesies of criticism; and we would point out that strong language often covers a weak argument, and that while you set out no reason for disputing our opinions, you discuss them with what we cannot but call insolent abuse. We have no objection to hostile criticism, provided it be fair. Your criticism cannot be so called, as it attempts to prejudice the public by taking up past failures, and insinuating doubts which you are unable to substantiate.

L. DE FONBLANQUE,
Secretary, Incandescent Gas-Light Company, Limited.

Dec. 23, 1891.

[If this letter is the writer's idea of a proper answer to the article of which he complains, it is not ours; and the circumstance of its being written and sent to us for publication is, in our opinion, evidence that the "plentiful lack of wisdom" which has hitherto marked the counsels of the administration of this Company still injuriously affects the policy of the Board. In the first place, we repeat that neither the invitation to the recent "Press view" of the new Welsbach lamps, nor the reminder thereof, ever reached the office of the JOURNAL; and it would perhaps be as well for our correspondent to trace these communications. We may state, upon this head, that this is not the first time that business correspondence of the same kind intended for the JOURNAL has miscarried. We did not know that such a gathering as the one in question was to be held, and only drew information about the proceedings from the Press notices of it that appeared in due course. We do not entertain any feeling of resentment upon this score, as the writer suggests, especially as we hold "Press meetings" in detestation, and prefer inspecting novelties quietly, to seeing them paraded, with their best side outward, before a crowd of newspaper reporters who, with all their "independence," usually know nothing whatever of the things which they are expected to commend to the favourable consideration of the public. With regard to the assertion that we "do not dare to deny" the Welsbach claim, it may be pointed out that we merely repeat it, without either acceptation or denial, either of which we should base upon other evidence than the statement of an interested party, or even an impression derived from a cursory inspection. The rest of the letter does not call for comment. We repeat, however, that it is talking pernicious nonsense to vent a sweeping accusation against all gas companies of being so foolish as to be unaware that a truly economical apparatus for utilizing a necessary of life really tends to increase its consumption.—ED. J. G. L.]

The Storeage of Water, Filtration, and Mechanical Filters.

SIR,—It is a well-recognized fact that every year it is becoming more difficult to obtain an uncontaminated supply of water for our large cities and towns. The population is rapidly increasing, and spreading out over the watersheds; additional mansions are erected; and the land is cut up for building new townships. Water is just as near to the towns now as ever it was; but the increase of trade and commerce, and the number of houses, small farmsteads, mills, and factories which are always being built on the banks of the rivers, destroy the watersheds and pollute the streams. Refuse of various descriptions is poured into them; as well as the natural washings of towns, and the soakage and infiltration of impure water, arising from imperfect paving and bad workmanship in making drains. Again, the pleasure steamers and house-boats, in the case of large rivers, foul the streams to a certain extent, although on some rivers barges are employed to remove the refuse from such vessels. For the foregoing reason alone, river supplies that were once quite above suspicion are gradually becoming more unfit for dietetic purposes. The great catchment areas throughout the country will continue to grow worse, until the Government or the County Councils purchase the natural watershed that supplies a town with the first necessary of life, and properly fence and protect it, as is now done with the great reserves and watersheds at Melbourne. Cases of contamination are being reported annually; and the spread of fever at Swansea a few years since ought to serve as a lesson to all communities drawing their water supply from rivers or watersheds near inhabited and populous districts. The population of the country has risen to such an extent that it is imperative that our rivers and streams should be protected; more than this, that proper systems of dealing with sewage should be insisted upon, in order that the earth shall not be polluted with the discharge from myriads of cesspools percolating into the strata, and finding its way into the wells of water companies.

Water which carries decaying organic or vegetable matter should not be stored for any length of time, especially in summer, when the impurities continually accumulate at the bottom of the receptacle, and that which is deposited is by far the most injurious. Some of our large impounding reservoirs have never been cleaned out; and the stagnant deposits of growth and sediment which collect year after year, till they reach as much as 10 feet in thickness, become a source of danger in warm weather. The water-works manager should be compelled to clean all reservoirs, no matter how large, as well as his filters; for without constant cleaning and filtering, a pure supply of water cannot be obtained. Anyone who is acquainted with the cleansing of filters or reservoirs will acknowledge that to collect and store up such filth as is found in the settling-tanks must do incalculable harm. The clearing out of such reservoirs once a year, after much evil has been effected, and then proceeding to collect a further quantity of muck, is a delusion. All the sediment caught in the filter, or the precipitate in the subsiding reservoir, should be removed before it is possible for decomposition to take place.

Water-works engineers have made great improvements in the matter of engines, pumps, machinery, aqueducts, and reservoirs; but little has been done in altering or improving the mode of filtering. The filters now in use are of the same description as those first erected by the Chelsea Water Company. Numerous materials have been tried for the filtration of water on a large scale; but, after all, nothing has superseded sand. Many of the metallic substances have been found useful; and highly satisfactory results have been secured with them. But in most cases, when iron substances are used, the water is finally filtered through sand; and when done efficiently, having the proper area of filter-bed, and allowing the regulation rate of filtration as prescribed by the Water Examiner, a pure water is obtained equal to that drawn from wells in the chalk. Even here also micro-organisms are found; but, of course, these are met with in small quantities in a new filter-bed, for, however fine the sand, it cannot be fine enough to prevent all such things passing. Yet after the filter has been working a week, it becomes more efficient, and prevents both the micro-organisms and the still finer particles of suspended matter from going through the bed of sand. This is caused by a thin film of silt accumulating on the top.

Many people argue that organic matter cannot be removed by sand filtration; but if we take Dr. Percy Frankland's reports, we find that the Thames water, in November, 1887, yielded 81,000 colonies of microbes per cubic centimetre before filtration; and after passing through the ordinary sand filters, worked in the ordinary manner, it yielded from 53 to 1120 colonies. The well waters yielded 40 colonies; showing that, given large areas of filter, and efficient, intelligent supervision, so that forcing is not resorted to, results may be obtained equal to M. Pasteur's experiments. It is stated, in a recent report on the London Water Supply, "that if the results obtained from month to month could be relied upon as an index to the effect of filtration in eliminating objectionable matter from the water, the bacteriological

method would seem to afford a delicate and easily-applied test of the working efficiency of the filter."

The great elements of failure in our present system of filtration are the saturation of the medium with impurities, and the want of a quick and efficient method of cleaning the whole of the filter. Notwithstanding that remarkable results are obtained from filter-beds which have been at work for years, it must be acknowledged that the water is being filtered through a medium which is not wholly free from impurity; consequently, to produce a pure potable water, it becomes necessary to cleanse the whole of the filtering medium continuously. Perfect results are obtained by mechanical filtration; the whole of the medium consisting of about 5 feet of fine sand, sometimes mixed with iron, coke, and other substances, which is washed, scrubbed, and thoroughly oxidized every 24 hours. By these repeated, continuous, automatic, mechanical cleansings of the whole of the medium, the best analyses have been obtained; and the results are permanent as well as highly satisfactory, and fulfil the requirements laid down in the above report. Therefore, if we can, by the simple mechanical filtration of certain waters, remove the germs which do harm in producing disease, we have effected the efficient purification of that water.

The ordinary method of filtering water on a large scale requires such vast areas, that it is becoming apparent to many that this system must be superseded by the employment of suitable machinery to partially reduce the cost of labour, and effect a saving of time. This is being done in a number of instances up to 6 million gallons per day, at a less cost than by the original system; and it goes to show that, with further experience, similar results may be obtained with the larger supplies. Mechanical filtration has passed the experimental stage, and is now specified in new works as a necessary portion of the machinery. Not only is this the case in America and on the Continent, but in England also it is fast becoming recognized as of the utmost importance. There are great advantages in being able to clean a filter promptly and efficiently; in fact, the whole secret is in the cleansing of the medium. It is not sufficient to form a filter with pipes for reversing the current, and provide no means of agitation. The particles of sand should be subject to abrasion; that is, the sand, being put in motion, requires radial arms revolving in opposite directions, or some other appliance, to force the grains one against the other, or a small air-pump may be used to make the agitation more brisk, so that the attrition of the particles of sand against each other may scrub off their own impurities.

The ideal source of water supply is unquestionably the mountain stream. As the water dashes upon and tumbles off the numerous boulders, down steep declivities, it takes up the oxygen which gives it life. Such aëration of water is adopted in mechanical filters, and is a recognized improvement. Numerous engineers construct waterfalls for "breaking up" the water, which takes up oxygen during its fall; others make obstructions in the open aqueduct, so that the water may leap over them and be separated or divided up as it courses along to the reservoir. This may be more readily effected in mechanical than in other filters; and it is often done, when necessary, by compressed-air engines, which are also used when a reverse current is applied for washing the filtering medium. It must be admitted that such a system of aëration will turn out or remove much of the organic matter carried in solution. I have found that with small supplies, the cost is considerably less with mechanical filtration than with the present method; and it is now fairly occupying the attention of those water-works managers who have trouble with their water, especially during hot weather. Mechanical filtration, efficiently carried out, is invaluable, although it is not an infallible and permanent "cure-all;" for it must be admitted that, if the supply becomes so bad as to require chemical treatment, a new source must be immediately sought.

Dec. 22, 1891. INSPECTOR.

Birmingham Corporation Water Scheme.—At a large and representative meeting of Shropshire and Radnorshire landowners, held at Knighton last Tuesday evening, it was decided to petition against the Birmingham Water Bill, as the clauses for their protection and interest were not deemed satisfactory.

The Water Supply of Pudsey and District.—The representatives of the Local Boards of Pudsey, Calverley, and Farsley have held a conference at Leeds with the Directors of the Calverley District Water Company, in order to make final arrangements for the transfer of the undertaking to the Local Boards. At the request of the Water Company, it was decided to extend their period of supply from Jan. 1, 1892, according to the agreement already entered into, until April 1, 1892, the Company to allow a deduction of £200 on the purchase price as a recompense for the extension.

A Gigantic Coal Syndicate.—A corespondent of the *Daily News* writes: "It is announced that a syndicate of capitalists, including some of the largest iron and coal magnates in the Midlands, is being formed for the purpose of opening up and working a vast mineral area, extending from the borders of Dudley for many miles through Staffordshire and Worcestershire. Mining engineers have reported favourably as to the existence of the famous seam of Staffordshire 10-yard coal in this extensive district, at present totally undeveloped. The new coal-field is expected to be the most important in the Midlands."

Accident to a Gas-Main at Elland.—We learn from a local paper that during the violent storm on Saturday, the 12th inst., an 18-inch gas-main over the Calder, between Elland and West Vale, was broken, and a large quantity of gas was lost. It appears that, as the river rose, two men were posted near the point where the main crosses, so as to repair any damage that might occur, and also report to the gas-works. Suddenly the two stone pillars which supported the main were swept away (it is thought they were struck by a tree or some other heavy object brought down the stream), and the main was broken, one or two of the pipes falling into the river. There was, of course, at once a serious escape of gas, which the men on duty did their best to stop by plugging the main. As quickly as possible, the Manager was communicated with, and the gas turned off; but not until, it is believed, about 50,000 cubic feet had escaped.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Friday, Dec. 18.

(*Before Mr. Justice* KEKEWICH.)

Savory and Moore v. The London Electric Supply Corporation, Limited. The Dangers of Electric Light Stations in Towns.

This was an action brought by Messrs. Savory and Moore, the well-known chemists and druggists, of New Bond Street, to restrain the defendants, who had been using certain buildings adjoining the plaintiffs' shop as an electric lighting station, from carrying on their business in such a way as to be a nuisance. As the case illustrates the danger arising from the establishment of electric light supply works in the heart of a town, or in contiguity with other buildings, we give a short statement of the cause of action, and the judgment of the Court therein, which, as mentioned in the JOURNAL last week, was adverse to the defendants.

At the rear of the plaintiffs' shop they have extensive premises which are used as a laboratory and store for large quantities of chemicals and other valuable goods of an inflammable character, including spirit tinctures and other spirituous preparations. In 1887 the defendants, who carry on the business of electric lighting, took certain premises adjacent to the plaintiffs' ware-rooms, and they were also in occupation of the cellars under the Grosvenor Gallery, which lay near the plaintiffs' premises; and they fitted up their buildings and cellars with engines, boilers, and other machinery for the production of electricity and the general purposes of their business. The plaintiffs alleged that in 1890, owing to their remonstrances, the defendants ceased to generate alternating electric currents as they had previously done in their buildings and cellars, and removed the boilers, engines, and machinery. In lieu thereof, they, without the plaintiffs' knowledge and sanction, proceeded to adapt and use their buildings and cellars as a converting and distributing station at which electric currents, received from their generating station at Deptford at extra high pressure, were converted by transformers to moderate pressure, and then distributed to their customers in the district. The plaintiffs complained that the use by the defendants of their buildings and cellars for this purpose, and in particular the collection and use there of a large number of electric cables and transformers, which were of a highly inflammatory and combustible nature, even with the greatest precaution both in the construction of the buildings and the mode of carrying on the business, was and must be attended with great risk of fire, and was highly dangerous to the plaintiffs' premises. They further stated that, on the 17th of October and the 15th of November, 1890, fires broke out on the defendants' premises, both of which occasioned great risk to the plaintiffs. By the second of these fires, the defendants' premises were practically gutted; and damage was caused to the plaintiffs by the attendant dirt, water, and smoke. As the defendants were proceeding to reinstate their premises with the view of employing them for the same purposes as before, the plaintiffs commenced the action in November last year; claiming an injunction to restrain them from doing so, and from otherwise using their premises so as to occasion a nuisance. The defendants denied that their business was attended with risk from fire, or would be dangerous to the plaintiffs' premises; and they stated that they had proposed to the plaintiffs to take certain precautions against accident. They also stated that they had obtained the approval of the Board of Trade to the supply of the electric current from their premises; and they insisted that the storeage of highly inflammable and explosive materials in the plaintiffs' own premises created considerable danger to the defendants' premises.

Mr. WARMINGTON, Q.C., and Mr. VERNON R. SMITH appeared for the plaintiffs; Mr. MOULTON, Q.C., and Mr. W. F. HAMILTON represented the defendants.

At the conclusion of the evidence and arguments, his Lordship reserved judgment.

Justice KEKEWICH, in delivering judgment to-day, said: This is an action *quia timet*. I have not been careful again to study or expound the law applicable to cases of this class, as that was fully done in *M'Murray v. Caldwell*; and from Counsel's statement and the short note with which I have been furnished, my judgment appears to have been affirmed, or at least not disapproved, by the Court of Appeal. What was there stated is, at any rate, binding on me; and, being accessible to those whom it concerns, there is no occasion to repeat it. I proceed, therefore, to examine the facts before me on that basis. That there is now no imminent danger against which the plaintiffs are entitled to protection, is clear beyond dispute. That if the defendants' plans are perfected in their entirety there will be no such danger, is not equally clear, only because the defendants' plans above the basement are wanting in precision, and a disposition to be guided by circumstances; and the exigencies of trade form an awkward factor in the sum of possible results into which, of course, inexperience and carelessness largely enter. The powers, and therefore the dangers, of electricity cannot be regarded as known even by scientific men, with sufficient accuracy to justify a positive statement respecting possible results under hypothetical circumstances, especially when the locality is in the heart of a crowded city. That the caution and delay of the defendants, in the construction of their building and its contents, and the present incomplete state of the same, are to some extent due to the action of the plaintiffs, may reasonably be inferred from the proved facts; and, moved by this consideration, and by the absence of now imminent danger already mentioned, it occurred to me that a reliefless and costless end of the litigation would satisfy both parties. But the plaintiffs have required, as they are entitled to do, a decision on the merits; and for this purpose I must regard not the present but the past—not, except by way of explanation or comment, the incomplete building now existing, but the shell which met the eyes of the plaintiffs in November, 1890, and the facts to which that shell was due. To the claim of the plaintiffs thus treated, the defence is simply that the action was premature. "If," say the defendants, "you had waited only

a little while—if you had given only slight consideration to our reasonable assurances—you would have been satisfied that what had happened before would not and could not recur, and that any shortcomings of the past would be avoided in the future." The evidence conclusively proves that defendants' operations, as conducted prior to the 15th of November, 1890, were of imminent danger to the plaintiffs, and that this was due to two causes singly, or in combination—first, the inherent, if latent, danger of the works; and, secondly, the neglect of precautions. It follows that any injury to the plaintiffs' house resulting from a fire on the defendants' premises, would have been actionable; and seeing that the injury, if it happened at all, was likely enough to be serious, alarm was natural and justifiable. That it was still natural after the defendants' premises had been gutted on the 15th of November, 1890, is sufficiently clear; but was it justifiable? And if justifiable before the plaintiffs communicated with the defendants, did it remain so after that communication? The first question is concluded by what has been already said. Within a short period there had occurred on the defendants' premises two fires traceable to the causes above indicated. One was soon extinguished, and, so far as the plaintiffs were concerned, did no harm. The other, on the 15th of November, 1890, was of a more serious character—more alarming and more destructive. It destroyed the contents of the defendants' building, and the injury extended to the plaintiffs' premises. The injury to them was not great; but it is easy to picture the scene, and to see how readily results, happily rendered trifling, might have been converted into a serious calamity. Who can blame the plaintiffs for thinking that this incident was likely to be repeated with disastrous consequences, and that it behoved them to take measures for the protection of their property? Giving them credit for such acquaintance with the defendants' operations and their conduct of business as may reasonably be presumed, they would expect that, with as little delay as circumstances permitted, they would again make the building available for supply to their customers, and that, although they would probably adopt such improvements as haste allowed and additional precautions, yet the restored building and its contents would not substantially differ from those lately destroyed. The experienced past and the anticipated future, therefore, combined to make the plaintiffs apprehend danger, and to urge them to take active measures for prevention. This they did promptly and prudently. They sought advice, and on that advice issued a writ. They might, of course, before issuing the writ have put themselves in communication with the defendants or their advisers. But there was at least this advantage in the course adopted, that, while preparing themselves for the next step, they were able to state precisely what that step would be, and to formulate their complaint, and the terms they were prepared to accept, beyond possibility of cavil or dispute. Then they communicated with the defendants' solicitors, and they did so in a temperate letter deserving commendation. In that letter they asked for an undertaking in the terms of the injunction which they claimed by their writ, and which they now claim at the trial of the action. I hold that they were right in asking for that undertaking; and if it had been given, there would have been no further trouble. It was not given. After reasonable and brief delay, there came the reply of the 15th of December. The first part so fully admits the case made by the plaintiffs as regards the facts of the past and the grounds of apprehension for the future, that one might have ventured to rely on it without further evidence; and there follows, as might be expected, a recognition of the necessity of additional precautions and assurances that they would be taken. The letter so narrowly approached to a sufficient undertaking, that the plaintiffs were well advised in not simply rejecting it as insufficient. Yet it was not what the plaintiffs had asked. Apart from other criticisms, it is to be observed that it expressed only the intention of the defendants, and offered no obligation to fulfil that intention, either by undertaking in the action or otherwise. The plaintiffs again demanded an undertaking, but failed to obtain more than a repetition, in a letter of the 12th of January, of the statement of the defendants' intention, and a reference to the Board of Trade rules, which apparently had been before neglected, and could not be taken as the measure of liability to the plaintiffs. The action, therefore, proceeded. There, having regard to the point falling for decision, I might properly pause; but it is convenient in this connection to mention that neither in April last, when the action came on for trial and was adjourned because the defendants' buildings were not complete, nor in the present month of December, 1891, when it was restored to the paper, did it appear what use will be made of the different parts of the building other than the basement, or that elements of danger from fire have been or will be completely removed. The plaintiffs now ask for an injunction in the terms in which they were willing to accept an undertaking. In my opinion, they are entitled to it; and the defendants must pay the costs of the action.

Proposed Electric Lighting at Featherstone.—At a meeting of the Featherstone Local Board last Friday week, a letter was read from Lord Masham, offering to light up North Featherstone for a term of 15 to 20 years with the electric light, for the sum of £20 per year and 4d. per hour during the time the current was used. A resolution accepting the offer was carried. At present the district is lighted by oil-lamps.

The Sulphate Plant at the Middleton Gas-Works.—We learn that the sulphate of ammonia plant recently erected by Mr. Maurice Schwab, of Manchester, for the Middleton Corporation Gas-Works, is acting most satisfactorily. It consists of this maker's latest improvements in liming arrangement, spent liquor overflow, &c.; also the Wilton patent closed saturator, with discharger. The whole of the plant works quite automatically, and requires very little attention; the only labour needed being in lifting the salt from the draining-table to the store-room, which is close at hand. The plant is attended to by the two enginemen in their respective shifts, and in conjunction with their regular exhauster work; the cost for wages amounting to 3s. per ton of salt made. The stills work effectively with 6 lbs. of steam pressure; and the discharger with the least possible turn of the wheel of a 1-inch valve.

MISCELLANEOUS NEWS.

CHRISTMAS TIME AT THE YORK GAS-WORKS.

Mr. Sellers's Address to the Workmen.

Last Thursday, Mr. Charles Sellers, the Secretary and Manager of the York Gas Company, gave his usual Christmas address to the men employed in the works. He said:

We are again on the threshold of another year; and, as time rolls on, my desire to keep alive the associations of Christmas grows upon me all the stronger. Let me, then, in the cheery spirit of Auld Lang Syne, wish each and all of you the old, old wish of a Merry Christmas and a Happy New Year. Let me, I say, renew the touch of our common industry which "makes us all akin," and shake hands with you all round. The year just closing has not been an eventful year to our ordinary work; but the last few months have seen a shrinkage in the public estimate of gas securities which is not creditable to public judgment. But I am aware that money is a sensitive thing—as sensitive as the proverbial sensitive plant; and moneyed men, when moved by fear, are not unfrequently like sheep, frightened at their own shadows. Like sheep, too, when they are frightened, they are all frightened together. And, although in this instance it may not be their own shadows which have caused them alarm, it is something equally groundless—viz., the shadows of our competitor, the electric light. But timid shareholders have nothing to fear. Existing gas capital is as solid and safe as is our own employment. There is room enough for both systems of lighting, while the field for the uses of gas is, widening every day, so much so that the parody of Tennyson's Brook—that

> "Light may come,
> And light may go,
> But gas goes on for ever"—

is in the judgment of competent authorities, and is, as far as human foresight can reach, as likely to be true now as these competent authorities regarded gas before the electric light came upon the scene; and flighty people who talk otherwise are the very people who have not a shilling invested in gas property. Leaving what may be called "shop," I desire to say a word upon two events of the passing year, outside the gas world, in which all working men should feel a special interest. I refer to the passing of the Free Education Act and the adoption by the city of the Free Library. There are enthusiasts, I know, who would almost have us believe that under these measures every man will be made a philosopher. But let me assure you that the conditions for obtaining knowledge will not be altered one iota. "He that will not work, neither shall he eat," will apply as closely to the man who will not work for knowledge; for such a man would be no more justified in his hopes to get knowledge without working, than would a man, because he owns a field, be justified in expecting a harvest if he does not work for that harvest. Free education will provide the keys of knowledge; but no man will unlock the treasures of art, science, and literature who ignores the beaten track, in the hope that, like men who make haste to be rich, he will find out some short cut—some "royal road." We all profess to believe that "wisdom is above rubies," and that "her ways are ways of pleasantness, and all her paths are peace;" but the indolent man, and the man who regards extra work as a hardship, and the men—for they may be counted by thousands—who put their leisure hours into pint pots, will no more find Wisdom's ways than a gold miner will find gold as easy to get as digging for potatoes. But I admit that these remarks will scarcely apply to the majority of those around me; for there are two classes of men who rarely do much digging for scholastic knowledge. First, the young men who have become worshippers at the shrine of some Nancy Lee or some blue-eyed Nellie; and very pleasant worship it is, for it never exacts from its votaries any sacrifice greater than the giving now and then of little collections into the lap of Love's young dream. And, secondly, there are the married men, whose time is mainly absorbed in providing comforts for their Nancy Lees and blue-eyed Nellies, and who, especially when they approach "the sear and yellow leaf" of life, cease to "write ballads to their mistress's eyebrows," and, instead of studying for knowledge, slide into their slippers and arm-chairs. But men's duties do not end here. On the contrary, their more responsible duties only just commence; and it is for the children of married men—the men and women of the next generation—for whom I now plead. It is, I say, for the children that the Free Education and Free Libraries are more especially provided; and it is for you to see that your children do not neglect the advantages offered. And those of you who have children of school age will reap a double advantage, for, being freed from the payment of school fees, your incomes will be bettered by, I venture to say, on an average, a full shilling per week. We all acknowledge, too, that "just as the twig is bent the tree's inclined;" and if you bend your children's minds to utilize the educational means now offered, and encourage them to work in the field of knowledge, you may depend upon it that when they are old they will not depart from it. It is true that all cannot be great in scholarly attainments, as it is equally true that all cannot become Lord Mayors of York; and as long as the present craze for mere amusement lasts, and real work is spoken of disparagingly, the numbers of the really great will be almost as scarce as hens' teeth. But we may all become intelligent, and be lifted out of the vulgar ruts of thriftlessness, drunkenness, and poverty, which are so largely the product of ignorance. Let us, then, all try to do our duty, for we can all learn to do that; and as long as we are the servants of the York United Gaslight Company, governed as the Company is by a body of fair-minded men, let us loyally sing—

> "Always do your duty, boys,
> Like young Britons bold,
> Thoroughly and heartily,
> When and how you're told.
> Put your shoulder to the wheel,
> Put your best feet 'fust;'
> Whatever be the obstacle,
> At it till it 'bust.'"

On account of the great pressure put upon the Company by the extremely cold and foggy weather, all the workmen could not be present, and therefore the distribution of the usual gifts to their children was postponed until Saturday.

THE SWINTON LOCAL BOARD GAS BILL.

The Clerk of the Barton and Eccles Local Board reported to a meeting of that body on Wednesday last week that he had received a notice from the Solicitors to the Swinton and Pendlebury Local Board, of that Board's intention to promote a Bill in the ensuing session of Parliament to purchase a portion of the gas undertaking of the borough of Salford and also to supply, among other places, the district of Eccles with gas. The maximum price of gas under the Bill, he said, was to be 4s. per 1000 cubic feet; while in Salford it was 5s. The illuminating power of the gas would be equal to 14 candles; but in the borough, he believed, it was 16 candles. The clause referring to Eccles read as follows: "If at any time within one year after the passing of this Act, the Barton Local Board shall apply to Parliament for power to purchase such portion of the gas undertaking of the Local Board as shall be situate within the Barton district, and the other districts included within the limits of gas supply of the Local Board, except the district and the township of Clifton, and to supply gas within such districts, then it shall not be lawful to oppose such application; and if such powers of purchase and supply be granted, the Local Board shall sell, and the Barton Board shall purchase, such portion of the gas undertaking of the Local Board, at such price and upon such terms and conditions as shall be fixed." The consideration of the clauses of the Bill was deferred.

The ratepayers of Eccles held a meeting a few days ago to discuss the proposal of the Swinton Local Board to supply Eccles and the out-districts beyond Salford (Prestwich excepted) with gas. The Secretary of the Ratepayers' Committee (Mr. T. Parton) was instructed to obtain a copy of the Swinton Bill; and a Sub-Committee was appointed to consider its clauses, and to support the Local Board in any action they may take against Swinton. In case the Eccles Local Board fail to take action, the Committee will be empowered to oppose Swinton. It was stated, however, that a petition was being signed in Swinton against the Local Board proceeding with their Bill. It was also decided to send a letter to the Local Government Board, calling attention to the fact that the Chairman of the Eccles Local Board, at the recent poll on the gas question, neglected to protect the interests of the ratepayers in not securing from the petitioners a guarantee that they would pay the cost of the poll, and asking that the ratepayers be not saddled with the expense.

THE GAS QUESTION AT BIDEFORD.

Opposition to the Gas Company's Provisional Order—Proposed New Works.

In the JOURNAL for the 8th inst., it was stated that the Bideford Town Council had decided to oppose the Gas Company's Provisional Order, and a Committee was at the same time appointed to inquire into the question of the purchase of the gas undertaking. The Corporation met on the 18th inst. to receive the report of the Committee, who recommended that the Council should intimate to the Company that they were prepared to negotiate for the purchase of the gas-works upon the basis of arbitration. The adoption of the report having been moved and seconded, a discussion followed; several members declaring themselves against hastily taking such an important step as committing the Council to purchase the gas-works before they had any idea of what the price would be. Mr. Squire spoke strongly against doing more than merely opposing the Company's application for a Provisional Order, as did Mr. Ascott; while Mr. Braddick stated his determination to go "dead against" any proposal to buy an old, worn-out, and inadequate property. After some further discussion, it was decided to postpone passing any definite resolution until after the ratepayers' meeting to be held on the subject.

The meeting of the ratepayers took place on Monday of last week, The Mayor (Mr. R. Dymond) moved that the resolution of the Town Council to oppose the intended application of the Gas Company for a Provisional Order be confirmed. Mr. Pollard, in seconding the motion, said the Council wished to prevent a monopoly in lighting the town. The Council had decided that the Gas Company should not break up the roads when and as they liked; but the Company did not like this restriction, and intended to apply for an Order, giving them excessive powers and privileges, which would be an injury to the interests of the town. Mr. Heard suggested that, instead of buying old obsolete works, the town should build new and modern works for itself. Mr. Molesworth also expressed the opinion that it would be better for the town to build new works. The resolution was carried unanimously. Mr. Heard then moved—"That it be a recommendation from this meeting to the Council to seek a suitable site as near Bideford as possible, and to get plans for modern gas-works, and that notice be given to the Board of Trade of such intention. The Mayor said he thought the resolution was premature; but Mr. Heard insisted that it should be put to the meeting, and Mr. Lee seconded it. Alderman Braund proposed, as an amendment—"That this meeting recommend the Town Council to call in an electrical engineer, and obtain a report on the feasibility of lighting the streets with electricity." Mr. Husband seconded the proposition. Mr. Cock said he would rather resign his seat on the Council than support such an unjust resolution. Mr. Ascott held the same opinion. He believed the resolution would be an exhibition of bad blood, which would prejudice the opposition of the town to the Gas Company's Order. However, after considerable further discussion, the amendment was carried by a large majority.

Mid Kent Water Company.—This Company are about to extend their works, by building a new low-level service reservoir, and laying mains in Halling, Snodland, Birling, &c., at an estimated cost of £7500.

Rating of the Liverpool Water-Works.—The Water Committee of the Liverpool Corporation have been successful in an appeal before the Assessment Committee of the Llanfyllin Union from the assessment made by the Overseers of the water-works within the Union. The Overseers' assessment was £20,339; and it was reduced to £5085.

METROPOLIS WATER SUPPLY.

The Quality of the Water during November.

The returns furnished to the Registrar-General by the London Water Companies as to the water supply of the Metropolis during the past month, show that the average daily supply was 173,045,298 gallons, as compared with 171,127,721 gallons in the corresponding month of 1890; being at the rate of 28·5 gallons per head of the population. Of the entire bulk of water sent out, 87,757,528 gallons were drawn from the Thames, and 85,287,770 gallons from the Lea and other sources. Reporting upon the quality of the supply, Dr. E. Frankland said: "Taking the average amount of organic impurity contained in a given volume of the Kent Company's water during the nine years ending December, 1876, as unity, the proportional amount contained in an equal volume of water supplied by each of the Metropolitan Water Companies and by the Tottenham Local Board of Health was: Kent, 0·8; Tottenham and East London (deep-well), 1·6; Colne Valley, 1·9; New River, 3·4; Lambeth, 3·8; Grand Junction, 4·6; Southwark, 4·7; West Middlesex, 5·2; East London (river supply), 5·8; and Chelsea, 6·6. The water abstracted from the Thames by all the Companies, except the Chelsea, was, in respect of organic contamination, of much better quality than that reported upon in October; but the water delivered by the Chelsea Company, which was by far the best in that month, was the worst in November, and contained no less than 73 per cent. more organic matter than that supplied by the Lambeth Company on the same day. All these waters were efficiently filtered. The water taken chiefly from the Lea by the New River Company was only slightly better than the best of the Thames waters; while that obtained from the same river, but lower down the stream, by the East London Company, was inferior to all the Thames waters, except that supplied by the Chelsea Company. Both Companies sent out efficiently filtered water. The deep-well waters of the Kent, Colne Valley, and East London Companies, and of the Tottenham Local Board of Health, were, as usual, of excellent quality for dietetic purposes; and the Colne Valley Company's water, having been softened before delivery, was rendered suitable for washing. All these waters were clear and bright without filtration. Seen through a stratum 2 feet deep, the Kent, Colne Valley, Tottenham, and East London (deep-well) waters were clear and colourless; the New River, clear and very pale yellow; the Southwark, Grand Junction, and Lambeth, clear and pale yellow; and the remaining waters were clear and yellow. The bacteriological examination by Dr. Koch's process of gelatine plate culture gave the following results: One cubic centimetre of each water, collected on the same days as the samples for chemical analysis, developed the following numbers of colonies of microbes: Kent, 46; New River, 64 West Middlesex, 194; East London (river supply), 208; Chelsea, 410 Lambeth, 642; and Grand Junction, 802."

Messrs Crookes, Odling, and Tidy, in their report for the past month on the composition and quality of samples taken daily of the water supplied to London, say: "Of the 175 samples examined, all were found to be clear, bright, and efficiently filtered. Throughout the month of November, the condition of the water supplied to the Metropolis, although, by reason of the continued exceptionally flooded state of the rivers, falling short of the standard usually maintained at this season of the year, showed an appreciable improvement on that prevailing during the latter part of the preceding month. This improvement is greater than would appear from a mere comparison of the mean results afforded by the examination of the two months' respective supplies the means afforded by the previous month's supply having been kept down by the good results furnished in the early part of the month, before the effect of the floods began to be seriously felt. Taking the Thames-derived supply for comparison, the mean amount of organic carbon present in this month's supply was found to be 0·250 part in 100,000 parts of the water, with a maximum of 0·391 part in any single sample examined, as against a mean of 0·197 part and a maximum of 0·422 part in the previous month's supply. As regards the oxygen expended in oxidation, the mean amount was found to be 0·101 grain, with a maximum met with on the 2nd of the month, in any single sample examined, of 0·184 grain in a gallon of the water, as against a mean of 0·083 grain and a maximum of 0·169 grain in the case of the previous month's supply. On the other hand, the maximum amount of oxygen expended in oxidation of the organic matter present in any single one of the 100 samples of Thames-derived water examined during the last 20 days of November was 0·132 grain per gallon; whereas in the 50 samples examined during the last 10 days of October, there were 30 samples in which the amount of oxygen expended varied from 0·134 to 0·169 grain per gallon."

THE PROPOSED PURCHASE OF THE NORWICH WATER-WORKS BY THE CORPORATION.

Failure of the Negotiations.

At the last Meeting of the Norwich Town Council—the MAYOR (Mr. G. M. Chamberlin) presiding—a report was received from the Water Committee recommending that, in consequence of the refusal of the Directors of the Norwich Water-Works Company to place before the shareholders the offer of the Corporation to purchase the undertaking at a premium of 10 per cent. beyond the market value of the shares, no further steps be taken at present to purchase the works.

Mr. WHITE said he rose to move the adoption of the report with very great regret, because he felt that this project was a most desirable one in the interests of the citizens; and he could not dismiss the subject without justifying the action of the Committee, and saying a word or two upon the matter generally. The Committee had done what was in their power to carry out the instructions of the Council; but having failed, they must fall back on the Council, leaving that body to take whatever steps might be thought desirable with a view to future action. He did not think a parallel case could be found in any city in the kingdom—no case in which the Corporation had been received in such a way as the Norwich Corporation had been

by the Water Company. The Directors had not even considered it worth while to consult the shareholders in any respect whatever, so far as could be gathered. He knew that one Director, who was also a large shareholder (Mr. Gurney Buxton), was in favour of receiving the offer of the Corporation. It was a fact most patent to everybody that this had been a case of the officials against the shareholders. It was not for the interest of the officials to allow negotiations to take place between the shareholders and the Corporation, and neither did they consider it desirable to consult the shareholders upon the matter. At Ipswich negotiations began in December of last year; and within the year the purchase of the water-works was carried out, without the least friction, and with comparatively little difficulty. When it was remembered that the offer made to the shareholders of the Norwich Company was vastly better than the offer which the Ipswich Company had accepted, it would be seen that the failure at Norwich was not because of the inadequacy of the offer; it was rather because the officials were totally indisposed to have anything to do with the Corporation in regard to this matter. Ipswich had purchased the water-works for 28 years' purchase on the average of the last four years' profits. The sum of money offered at Norwich would, as far as he could see, on a fair estimate of the market value of the undertaking, have amounted to 32 years' purchase. He ventured to say that the Directors had refused an offer which was not likely to be repeated either by the Corporation or any other body which might contemplate the purchase of the works. The gross receipts of the Norwich undertaking for the year ending September, 1890, were £20,360, and the net profits were £11,812; whereas the gross receipts at Ipswich were £11,244, and the net profits upon the gross receipts were £7461. The capital sum which it had been proposed to put into the pockets of the shareholders, if they had accepted the offer of the Corporation, could not have been far short of £50,000. The attempt to purchase had been made, and he regretted to say it had failed; but this was not due to any want of liberality on the part of the Corporation or any desire not to treat those connected with the Company in the most liberal spirit possible.

The DEPUTY-MAYOR, having remarked that he quite agreed with Mr. White's remarks in regard to the almost unique character of the negotiations, said that the Committee entered into the negotiations, not with a view to make a large profit, but purely to benefit the city in sanitary matters. They would for some time have been losers of £2000 or £3000 a year to begin with; but they felt that the water-works would be better managed if they were in the hands of the Corporation, because they would have the opportunity of putting in force certain compulsory powers which the Company could not do; and these would materially conduce to the health of the city.

Mr. CROTCH thought the Corporation ought not to sit down and abide by the refusal of the Directors of the Company. Some shareholders had told him that they would be glad to take the 10 per cent. premium; and he therefore hoped the Committee would not drop the negotiations at the present stage.

Mr. GREEN said the Corporation had actually offered the Company £100,000 more than the works cost them; and he was surprised that the shareholders were content to be overruled by a small Committee. The offer made was £60,000 more in proportion than the amount paid for the Ipswich works.

The report was then adopted.

THE PURCHASE OF THE IPSWICH WATER-WORKS BY THE CORPORATION.

Public Meeting of Ratepayers.

A Meeting of Ratepayers was held at Ipswich yesterday week, to consider the proposed purchase of the water-works by the Corporation. The chair was taken by the Mayor (Mr. D. Ford Goddard), who, after a few introductory remarks, proposed a resolution giving the Town Council the sanction of the owners and ratepayers to the acquisition of the undertaking. Speaking in support of the resolution, he said that a provisional contract had been entered into to purchase the concern for the sum of £200,000. There were several reasons why they should have control of the water supply in their own hands. In the first place, there were some of the ratepayers who were of opinion that the present charge for water was too high; but so long as the supply remained in the hands of the Company, they had no power to reduce the charge, at least until the Company had to go to Parliament for another Act, when they might, perhaps, get some reduction of terms. Seeing, however, that the Company had only called up £61,000 of the £100,000 they were empowered to raise, it might be fairly assumed that they would have at least another 30 years' life before the ratepayers would have a chance of "putting in a spoke" in regard to the charges for water. Besides this, at the present time the town could not use for public purposes any other water than that which was supplied by the Company; and so long as the existing conditions continued, they could not avail themselves of the natural water power which the town possessed in its tidal river. It was estimated that if they conserved some of the water at high tide, which came twice a day, they would realize something like 50-horse power, which would be enough to do a good deal of work in Ipswich at a very small cost indeed. Then there was another reason. The experience of other towns had shown that the possession of a water undertaking was a source of profit to them. More than one-third of the water undertakings of this country were held by local authorities. Somewhere about 200 water undertakings were at the present time in the hands of the local authorities; and the great majority of these were not only paying interest on the loans which they were obliged to levy to pay for the water undertaking, and paying back into the sinking fund the money required to liquidate them at one time or another, but most of them were contributing considerable sums towards the reduction of the rates. No less than 85 out of every 100 of the towns holding their own water-works received something in the way of relieving their rates by that possession. The next question was, Would they be burdening the borough with an undue debt if they contracted the heavy loan which was necessary to secure the water undertaking? Taking 58 municipal boroughs which at the present time had power to create municipal stock, the proportion of debt in these 58 boroughs—the proportion of debt to the yearly rateable value—averaged 2·65. In Ipswich it was only 1·17; and if they added to their present indebtedness the amount which was necessary for them to borrow to secure the water undertaking, it would then be only 2·11, which was considerably under the average of the 58 municipal authorities. Then there was the question of the price that they ought to pay for the undertaking. Some might think it was too high a price. He ventured to say that it was very difficult for anyone to be able accurately to say what was the fair price of an undertaking like this. But having carefully examined into the undertaking and all its plant, he would advise them to accept it rather than have to fight it out at some future time. Alderman Wrinch, in seconding the resolution, said that although they were going to ask in the Bill for leave to borrow £230,000, they should certainly require no more than £210,000; and if they could borrow this at 3¼ per cent. instead of 3½, he thought they could not by any possibility want more than a 1d. rate for the first year, instead of the 1½d. rate proposed. Mr. Martin Crannis made a rambling speech in opposition to the purchase of the works; his principal point appearing to be that the water-mains were in a "rotten" condition. Mr. Fisk, while believing that the undertaking ought to be in the hands of the Council, said they had no guarantee that the rate just mentioned would not be exceeded; and if the Corporation could substitute an additional loan for the rate, he would support the scheme. Mr. Abbott remarked that if the Chairman could assure them that the rate-in-aid would not be put into force, many ratepayers would support the proposed purchase. Mr. Cattermole and other gentlemen, including two members of the Ratepayers' Association, supported the resolution, which was afterwards carried with practical unanimity. A vote of thanks to the Mayor concluded the proceedings.

The Fog and the Manchester Gas Supply.—The fogs last week led to an exceptionally heavy drain being made on the resources of the Manchester Corporation Gas-Works. On Monday the fog was exceedingly dense throughout the whole district; and the consumption of gas was the heaviest on record. The greatest consumption on a single day before was on Dec. 24, 1890; the total then being 20,857,000 cubic feet. Yesterday week, however, the record was carried up to 21,086,000 feet. The consumption on an ordinary winter's day is about 17,000,000 feet; and, in the present state of the gas-works—the extensions undertaken some time ago not having been completed—this is quite sufficient for the resources of the Corporation. A fairly good supply was forthcoming during the fogs; but it was found necessary to limit the pressure to a slight extent.

Bilston Gas Company.—In the report to be presented to the shareholders of this Company at their meeting on the 4th prox., the Directors express their gratification that, during the year ending Sept. 30 last, there was an increase of 6¼ per cent. in the sales of gas; and this, with the additional revenue derived from the sale of residuals, to some extent compensated for the rise in the price of coals, labour, &c. Reference is made to the projected amalgamation of the Company with the Willenhall Gas Company, for which permission is now being sought by Provisional Order. From the accounts accompanying the report, we find that the profits on the year's working are again insufficient to allow the payment of the usual dividends; and it is therefore proposed to take the difference (£450) from the unappropriated profits of previous years. The balance of the profit and loss account is £4156; and the Directors purpose paying dividends of 5s. and 3s. 6d. per share on the "A" and "B" shares respectively; making with the interim dividends 10s. and 7s. for the year. The balance to be carried forward will be £1741.

The Willenhall Local Board and the Gas Company.—The question of the amalgamation of the Willenhall and Bilston Gas Companies was before the members of the Willenhall Local Board yesterday week; and, after considering the matter, the Clerk was instructed to write to the Solicitors of the Gas Company informing them that the Board had decided to oppose the Provisional Order in which power was sought to carry out the proposal. At the same meeting, a letter was read which had been received from the Local Government Board, stating that the time allowed for the repayment of loans for the purchase of gas-works was thirty years; but they would not be able to state definitely what period of time would be allowed the Willenhall Board until they had before them the report of the Inspector who would attend the inquiry held on the matter of any proposed purchase of the works. The Chairman (Mr. Jesse Tildesley) announced that the question of acquiring the concern would be discussed at a meeting of the Board to be held as soon as the Company's Provisional Order was issued.

Lecture on Coal Gas at Middleton.—In connection with the Middleton Literary and Scientific Society, on the 16th inst., Mr. T. Duxbury, the Manager of the Middleton Gas-Works, delivered a lecture on "The Distribution and Economic Consumption of Coal Gas." The lecturer first gave a number of statistics to show the magnitude of the gas industry, and then he proceeded to describe wet and dry gas-meters, and also the working of Messrs. Orme and Co.'s prepayment meter. Small meters, he said, were often made to do too much work; and, therefore, the illuminating power was reduced, and in cases where complaints had recently been made as to the quality of the gas in the town, after a careful examination, the fault was not his (Mr. Duxbury's) at all, but the meter used was found to be too small for the work required of it. He next referred to the illuminating power of the gas, and showed how the power could be very much reduced by consumers using poor gas-burners, and also by the globes used obstructing the light to a very great extent. As a remedy for the latter, he advised consumers not to employ ground glass or opal globes if they wanted to obtain the fullest value of the gas, but either common window glass or clear glass globes. The lecture throughout was extensively illustrated; and, at the conclusion, a hearty vote of thanks was accorded to Mr. Duxbury.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday.*

Can anyone give a reason for the extraordinary outbreak of explosions of gas which we are experiencing? Blackburn, Glasgow, and London have been the scenes of violent explosions; and yesterday, in both Aberdeen and Perth, there were explosions of considerable severity. At Aberdeen, a lady, who keeps a house on the upper floor of a tenement in Holburn Street, on getting up between six and seven o'clock in the morning, noticed a strong smell of gas in the sitting-room, and heard a gurgling noise proceeding from the gaselier. It being dark at the time, she struck a match to enable her to see what was wrong, with the result that there was an explosion. She and her employer were both thrown down, but not injured. The most serious effect of the explosion was a dislodgment of the roof, which caused a portion of an ornamental stone balustrade which surmounted the front wall of the building, to fall down, alighting on the foot-pavement and smashing a public lamp. This might have proved a serious matter; but there was fortunately no one about at the time. The Perth explosion was a much smaller affair. When the premises of the Clydesdale Bank, in St. John Street, were opened, an escape of gas was perceived; and the clerks took the wise precaution of opening the windows of the office to purify the atmosphere of the apartment. This does not seem to have been done so much to avoid an explosion as for their own comfort, for they set to work without endeavouring to discover where the escaping gas had come from. It turned out to be proceeding from a gas-jet in the enclosed room which is used as a safe. On the previous night, it is supposed, a burning jet had been, unobservedly, blown out by the shutting of one of the doors in the safe. A clerk, on going to the safe, ignorantly struck a light, and an explosion followed. He was the only sufferer by the accident; but his injuries amounted to no more than the singeing of his hair and a cut on the nose. The damage is estimated to amount to £20—quite enough to pay for a thoughtless act.

There is in Edinburgh an Electric Supply Corporation, in the shape of a private limited liability company, which, it seems to me, well illustrates the nebulous position of many similar companies throughout the United Kingdom. This Corporation, with unwonted frankness, revealed themselves to the world at their second annual general meeting on Wednesday, when the report of the Directors was submitted to the shareholders. How grandiloquent the affair looks, with its capital of £100,000, in 20,000 shares of £5 each, with power to increase the amount. How different it appears when it is stated that the capital is £80,000, in 16,000 privately issued shares; and that the privately subscribed capital is £31,175, the paid-up capital being £1558 15s. A curious financial mixture this, which brings out that there is 39s. subscribed upon each share, and 2s. paid up. The fact is that the Corporation is all but non-existent. Its only object is to take over, if it can come to terms with the Town Council, the electric lighting of the area which is scheduled in the Provisional Order for the city. The Town Council have not yet begun to move in the matter; and consequently the Corporation can do nothing. A feature of the Corporation, as explained in the prospectus, is that in the event of business not being entered upon—that is, if the Town Council does not give the lighting contract to them—the subscribed capital will bs returned in full, and the Directors will themselves bear the expensee which have been incurred. It may either be that these Directors are convinced that the Town Council is incapable of attending to the business of the city, or that (which is the more probable) the whole affair is a syndicate who are anxious to dip their hands into the public coffers. In his remarks at Wednesday's meeting, the Chairman made the explanation that "they objected very strongly to be tied to any one system." If the Edinburgh Electric Supply Corporation have, as they say, no method, but are attempting "to keep the city free to adopt the best obtainable," I should say it is the opposite of a recommendation to them. They must know this; and therefore it is just possible that the real explanation after all of the existence of the Company is not a desire to do business, but rather that, by making a show of being able to undertake it, they may force the city to go on with an electric lighting scheme, or allow them to step into the breach.

The Police Commissioners of Tain, having acquired the undertaking of the Gas Company, are losing no time in setting things in order. They have already given instructions for the reconstruction of the works and plant under the direction of a gas engineer of eminence; they have settled with the Gas Company; and they have reduced the price of gas from 10s. 10d. per 1000 cubic feet to 9s. for cash transactions and 10s. where credit is given. The figure is still very high; but a good beginning has been made, and it is to be trusted that further reductions may be possible, though, with the cost of reconstructing the works to be borne, it is doubtful whether such may be attained for some time.

From our Glasgow Correspondent.

GLASGOW, *Saturday.*

I rather think that this opening "Note" contains my most important item of gas news in this week's budget. It is the fact that the contract for the construction of the big gasholder at the Temple Farm Gas-Works has practically been decided this week; at least, so I am told. But before it is finally settled, the recommendation of the Sub-Committee on Contracts must be brought before the Glasgow Corporation Gas Commissioners for their formal approval at the first Council meeting of the new year. After making inquiry in two or three quarters (one of my informants being an ex-member of the Gas and Electric Lighting Committee), I have learned that the recommendation is that the contract should be placed with Messrs. R. Laidlaw and Son, of the Barrowfield Iron-Works, Glasgow. I have not yet been told how many tenders were sent in for the work; but I understand that there were at least seven, including the one which has been practically accepted. The other firms that tendered are said to be the following: Messrs. Hanna, Donald, and Wilson, Messrs. Clayton, Son, and Co., Limited, Messrs. Ashmore, Benson, Pease, and Co., Limited, Messrs. R. and J. Dempster, Messrs. S. Cutler and Sons, and Messrs. T. Piggott and Co. These names have all been mentioned to me on what I consider to be excellent authority; but I repeat them subject to correction. A contract for a holder which is to have a capacity for between five and six million cubic feet of gas is not to be had every week; and consequently there was on the part of those firms that sent in tenders a strenuous effort to be successful in securing this particular piece of work, evidence of which is seen in the fact that the amounts of the various tenders ranged, I believe, between about £40,000 and £47,000. One of my informants tells me that Mr. Foulis had calculated on the successful tender being well up towards the highest amount named. The holder is to consist of three lifts, the bottom one being 236 feet in diameter and 45 feet high, which is to be the height of the second lift, while the height of the third, I am told, is to be 46 feet. Steel plates and sheeting, rather than malleable iron, are to be used.

The proceedings at the fortnightly sitting of the Glasgow Police Commissioners last Monday brought forth something in the shape of a surprise to the citizens generally—an announcement that the Watching and Lighting Committee had entered into an arrangement with the Sub-Committee on Electric Lighting for George Square and several of the principal streets of the city being lighted by electricity, instead of by gas as at present. The proposed arrangement is based on a report (which is still private and unprinted) prepared by Mr. Arnot, the city electrical engineer; and according to ex-Bailie Gray, Convener of the Watching and Lighting Committee, it is calculated that the public electric lighting that is contemplated will only cost about £2200 per annum, or a few hundred pounds more than the gas lighting at present. The same gentleman says that, if this arrangement is carried out, it will be a great benefit to the city, by making it more attractive after dark, and by serving as a preventive of crime. Mr. Bell, Convener of the Electric Lighting Sub-Committee, states, on the authority of the electrical engineer's estimate, that the additional capital expenditure for the contemplated street lighting by electricity will be about £8000, the light to be supplied being about ten times that now given by gas. He affirms that no city in the kingdom could light its principal streets so economically and so well as Glasgow under this scheme will be able to do. It should be remembered that Mr. Bell is something of an electric lighting enthusiast.

The latest report to hand regarding the trade in sulphate of ammonia states that the depression continues, and that business for prompt delivery has been done at £10 2s. 6d. per ton; while for January to April delivery the price is £10 10s. per ton, f.o.b. Leith.

The increased activity which was commenced in the Glasgow pig iron warrant market last week, has become rather more pronounced; and a somewhat larger business has been reported, especially in Cleveland and hematite iron. The price of Scotch warrants remains at about 47s. per ton cash, while the closing prices on Thursday afternoon for Cleveland and hematite iron were, respectively, 38s. 2d. and 47s. 11d. per ton cash buyers. There is no special new feature in the legitimate trade, which is quiet.

The coal trade in the West of Scotland is steady; but little business is being undertaken, the coalmasters being busy getting orders fulfilled before the close of the year. There is a strong demand for immediate delivery; but difficulty is experienced owing to the scarcity of waggons. Prices are maintained at late rates—viz., Main, 8s.; splint, 9s. to 9s. 3d.; ell, 9s. to 9s. 3d.; and steam, 10s. 6d. to 10s. 9d. For gas-making purposes, splint coal has advanced in price 6d. to 9d. per ton.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Dec.* 24.

Sulphate of Ammonia.—There has been a better inquiry, and prompt parcels have moved off more freely; but there is as yet little alteration in values, although prices have a hardening tendency. There are buyers at £10 2s. 6d. at all the ports. But sellers generally hold for £10 3s. 9d. to £10 5s.; and as it is anticipated that there will be a good demand after the turn of the year, an improvement will probably take place then. Owing to the small December shipments, nitrate is firmer; and 9s. 3d. is again the lowest price.

LONDON, *Dec.* 26.

Tar Products.—There is great depression in this market; and were it not that pitch, which after all is 50 per cent. of the volume of tar, is in fairly good request, the outlook for tar distillers would indeed be black. Benzol goes from bad to worse; the fall in value during the year being about 2s. 6d. on "nineties" and 2s. on "fifties." Report has it that the increased quantities produced by coke-makers in Germany is the cause. To some extent, this is true; but the chief reason is the action of dealers, who are forcing the hands of buyers, knowing that sellers here must take the prices offered, whatever they may be. Aniline and aniline products are, however, very dull; and "bear" operators are emboldened by this. Anthracene is distinctly weaker, with a tendency to go lower. Oils are slow of sale; and makers are heavily stocked. Nominally, prices are: Tar, 19s. to 22s. Pitch, 34s. Benzol, 90 per cent., 2s. 4d.; 50 per cent., 1s. 9d. Toluol, 1s. 4d. Solvent naphtha, 1s. 2d. Crude benzol naphtha, 30 per cent., 1s. Creosote, 1d. Carbolic—crude, 1s. 2d.; crystals, 5d. Cresol, 9d. Anthracene, "A" quality, 1s. 2d.; "B" quality, 9d.

Sulphate of Ammonia.—There is no solid improvement in market values; but inquiries are better, and more business is doing. Important sales are noted at £10 2s. 6d. to £10 5s.; and for forward delivery 5s. more may be obtained—usual terms, less 3½ per cent.

THE LANCASHIRE GAS COAL TRADE.

From Our Own Correspondent.

With the close of the year, there has been rather a spurt in the coal trade of this district, although this may be only of a temporary character. The late spell of severe weather has necessarily brought forward increased requirements for house-fire purposes; while the usual holiday stoppages of the pits, which extend over six or seven days for Christmas and the New Year, have necessitated an extra weight of buying on the part of merchants and consumers, to carry them over

the holidays. For house-fire coals, prices are firm at full rates; but that no attempt is being made to put on any advance may be taken as an indication that the colliery-owners scarcely consider the present activity sufficient to justify an upward movement in prices. At the pit's mouth, best Wigan Arley remains at 12s. 6d.; Pemberton 4-feet and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 9s. to 9s. 6d. per ton. With regard to other classes of fuel, apart from the temporarily increased weight of buying going to carry on manufacturers and works over the holidays, there is no really appreciable improvement to notice; and to some extent the temporary cessation of operations of the collieries is being fully counterbalanced by prolonged stoppages of works—the Alkali Union ceasing operations for ten days. For the moment, sellers are not offering special lots in the market at the low figures that have recently been taken; but ordinary market quotations are not more than maintained at late rates—8s. to 8s. 6d. remaining the full average figures for steam and forge coals, 6s. 6d. to 7s. for burgy, 5s. to 5s. 6d. for best slack, 4s. to 4s. 6d. for good ordinary sorts, and 3s. to 3s. 6d. for common descriptions. The shipping demand has been more active, and prices have shown greater firmness; steam coals delivered at ports on the Mersey not averaging under 9s. 6d. to 10s. per ton.

Northern Coal Trade.—The holidays have interfered with the production of coal, and they have increased the consumption; so that many important users have had to reduce their stocks. Best Northumbrian steam coal is rather steadier; and from 10s. to 10s. 3d. per ton, f.o.b., is the general quotation, with second classes from 9s. to 9s. 6d. per ton. Small steam coal is dull, at about 4s. to 4s. 6d. per ton. For gas coal, the demand has been higher than ever known; the fogs in London having greatly increased the demand there, but also delayed the steamers engaged in the trade. The local consumption has been in excess of any previous record; and thus gas coal has been scarce, and high prices have been offered for any lots that were available. For general quotations, about 9s. 6d. per ton for best Durham qualities is usual. There is a rather better demand for coal for house purposes; but 11s. 3d. per ton is still the price at the land-sale pits. There is a fair demand for bunker coal, as well as for manufacturing fuel, when the season is remembered; but prices are lower for next year's contracts than they have been for this. Coke is in rather better demand; the prospects of the iron trade being momentarily better. Gas coke is being more freely sold for the cement works and allied contracts; and the price seems to be for next year about 10s. per ton.

The Wenham Company, Limited, have been entrusted with the lighting of the Covent Garden Opera House, for the forthcoming season of fancy dress balls, as well as supplying the lamps for the exterior lighting of Drury Lane Theatre during the run of the pantomime.

The Leeds Gas Committee and the Gas Workers' Union.—About fifteen members of the Gas Workers' Union who are employed at the Leeds Corporation Gas-Works met together yesterday week to consider the refusal of the Gas Committee to interfere between the Union and the defaulting members at the works. Mr. Cockayne, the Branch Secretary of the Union, was present, and explained to the men the issues that had arisen. He assured them that the officials were anxious that a strike should be avoided; and there was no doubt the men were of the same opinion. Only about six men had absolutely declined to pay the arrears of their subscriptions to the Union; and he thought that, by adopting a conciliatory attitude, they could be brought to concur in the view taken by the rest of their comrades. He advised the men to leave the matter in the hands of the officials; and a resolution to that effect was passed.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1176.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	15 Oct.	10½	Alliance & Dublin 10 p. c.	10	15½–16½	..	6 7 3
100,000	10	"	7½	Do. 7 p. c.	10	11–12	..	6 5 0
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109	..	4 11 9
100,000	20	27 Nov.	8	Bahia, Limited	20	12–14	..	11 8 6
200,000	5	12 Nov.	7½	Bombay, Limited	5	6½–6¾	..	5 11 1
40,000	5	"	7½	Do. New	4	4¾–5	..	6 0 0
380,000	Stck.	13 Aug.	12½	Brentford Consolidated	100	210–220	..	5 11 4
125,000	"	"	9¾	Do. New	100	157–162	..	5 14 2
220,000	20	16 Sept	11½	Brighton & Hove Original	20	40–42	..	5 9 6
883,500	Stck.	16 Sept.	5	Bristol	100	101–104	..	4 16 2
320,000	20	15 Oct.	11½	British	20	42–44	..	5 2 3
50,000	10	28 Aug.	11½	Bromley, Ordinary 10 p. c.	10	18–20	..	5 15 0
50,380	10	"	8½	Do. 7 p. c.	10	13–15	..	5 13 4
328,750	10	—	—	Buenos Ayres (New) Limited	10	6–7	..	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	92–96	..	6 5 0
150,000	20	13 Aug.	8	Cagliari, Limited	20	24–26	..	6 3 1
550,000	Stck.	15 Oct.	13¾	Commercial, Old Stock	100	240–250	..	5 10 0
161,396	"	"	10¾	Do. New do.	100	185–195	..	5 10 3
130,000	"	26 June	4½	Do. 4½ p. c. Deb. do.	100	119–124	..	3 12 7
800,000	Stck.	11 June	10	Continental Union, Limited	100	220–230	..	4 6 11
200,000	"	"	7	Do. 7 p. c. Pref.	100	190–200	..	3 10 0
75,000	Stck.	16 Sept.	10	Crystal Palace District	100	190–200	..	5 0 0
486,090	10	15 July	10	European, Limited	10	19–20	..	5 0 0
354,060	10	"	10	Do. Partly paid	7½	14–15	..	5 0 0
5,470,640	Stck.	13 Aug.	13	Gaslight & Coke, A, Ordinary	100	219–224	..	5 16 1
100,000	"	"	4	Do. B, 4 p. c. max.	100	94–97	..	4 2 5
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	248–253	..	3 19 1
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	118–123	..	4 1 4
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	172–177	..	4 4 9
1,300,000	"	"	7	Do. H, 7 p. c. max	100	155–160	–1	4 7 6
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	245–250	..	4 0 0
476,000	"	"	—	Do. K, 6 p. c. Prf.	100	145–150	..	4 0 0
1,061,150	"	11 Dec.	4	Do. 4 p. c. Deb. Stk.	100	110–114*	..	3 10 2
294,850	"	"	4½	Do. 4½ p. c. do.	100	118–123*	..	3 13 2
908,000	"	"	6	Do. 6 p. c. do	100	160–165*	..	3 12 9
3,800,000	Stck.	12 Nov.	12	Imperial Continental	100	218–223	..	5 7 8
75,000	5	26 June	6	Malta & Mediterranean, Ltd.	5	4–4½*	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5 p. c. Deb.	100	109–111	..	4 10 4
541,920	20	27 Nov.	6½	Monte Video, Limited	20	15–16	..	8 2 6
150,000	5	27 Nov.	10	Oriental, Limited	5	8¾–9	+¼	5 11 1
60,000	5	30 Sept.	7	Ottoman, Limited	5	4–5	..	7 0 0
166,870	10	26 Feb.	2	Pará Limited	10	2½–3½	..	—
				People's Gas of Chicago—				
420,000	100	3 Nov.	6	1st Mtg. Bds.	100	94–99	..	6 1 3
500,000	100	1 Dec.	6	2nd Do.	100	93–98	..	6 2 5
150,000	10	15 Oct.	10	San Paulo, Limited	10	11–12	..	8 6 8
500,000	Stck.	28 Aug.	15½	South Metropolitan, A Stock	100	265–275	..	5 12 9
1,350,000	"	"	12	Do. B do.	100	219–224	–2	5 7 1
200,000	"	"	13	Do. C do.	100	225–235	..	5 10 8
700,000	"	26 June	5	Do. 5 p. c. Deb. Stk.	100	140–145	..	3 9 0
600,000	Stck.	16 Sept.	11½	Tottenham & Edm'nton, Orig.	100	—	..	—
				WATER COMPANIES.				
729,331	Stck.	26 June	10	Chelsea, Ordinary	100	255–265	..	3 15 6
1,720,560	Stck.	15 Oct.	8	East London, Ordinary	100	198–203	+½	3 18 10
544,440	"	26 June	4½	Do. 4½ p. c. Deb. Stk.	100	138–143	..	3 3 0
700,000	50	11 Dec.	8	Grand Junction	50	97–102*	..	3 18 5
708,000	Stck.	13 Aug	10½	Kent	100	260–265	+3	3 19 3
1,043,800	100	26 June	9½	Lambeth, 10 p. c. max.	100	225–235	..	4 0 10
406,200	100	"	7½	Do. 7½ p. c. max.	100	192–197	..	3 16 2
260,000	Stck.	30 Sept.	4	Do. 4 p. c. Deb. Stk.	100	120–123	..	3 5 0
500,000	100	13 Aug.	12½	New River, New Shares	100	330–340	..	3 11 4
1,000,000	Stck.	30 July	4	Do. 4 p. c. Deb. Stk	100	125–127	..	3 3 0
902,300	Stck.	11 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	149–154	..	4 4 5
126,500	100	"	6½	Do. D 7½ p. c. do.	100	140–150	..	4 6 8
1,155,066	Stck.	11 Dec.	10	West Middlesex	100	245–250*	+2½	4 0 0

*Ex div.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

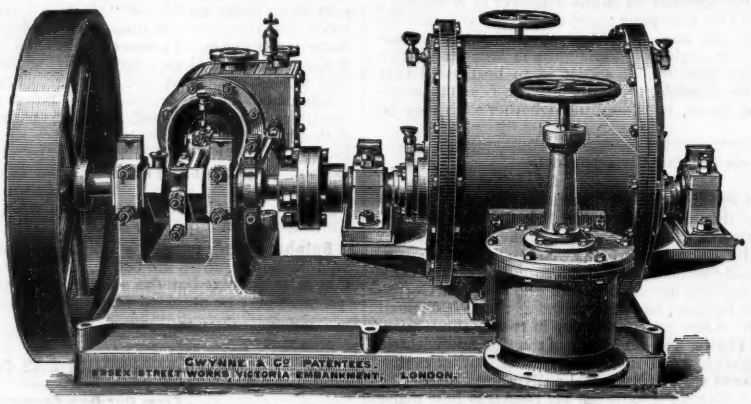
HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co., for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.



Engine and Exhauster Combined on One Bed-Plate.

GWYNNE & Co.'s Exhausters are constructed of large size to pass the required quantity of Gas at very slow speeds; the wear and tear being reduced to a Minimum.

Catalogues and Testimonials sent on Application.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; PATENT SELF SEALING AND CLEANSING RETORT-LIDS AND MOUTHPIECES; CENTRIFUGAL PUMPS and PUMPING ENGINES specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.

JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY LIMITED.

ANDREW STEPHENSON, Agent.

Please address all communications to the Company, as above.

ANDREW STEPHENSON, Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.

City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH.

Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, } SCOTLAND.
NEWTON GRANGE, NEAR DALKEITH, }

FRIEDRICH LUX, Ludwigshafen am Rhein; and at No. 142, Great Portland Street, London, W.

LUX'S Gas Regulators for every consumption.
LUX'S single-stem Pressure-Gauges.
LUX'S Regulator for Gas-Engines.
LUX'S Gas-Balance.
LUX'S new Gas Regulator for Inverted Lamps; and other Apparatus for Gas Lighting, &c.

DRAWINGS, Tracings, Specifications, Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.

Address J. L. FEATHERSTONE 173, Fentiman Road, LONDON, S.W.

WANTED, a position in Draughtsman's Office or Laboratory in Gas-Works by a Young Gentleman just leaving School. Can have the highest recommendations.

Address No. 2045, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GOOLE GAS COMPANY.

WANTED, a steady and experienced Man as MAIN and SERVICE LAYER, METER REPAIRER, and FITTER.

Applications, stating age, whether married or single, and salary required, accompanied by not more than Two recent testimonials, to be made to the undersigned not later than Monday, the 4th day of January next.

By order,
JNO. WHITAKER,
Manager.

SHEFFIELD UNITED GAS LIGHT COMPANY.

SUPERINTENDENT OF MAINS.

WANTED, by the Directors of this Company, an experienced and competent Man to SUPERINTEND their MAINS and SERVICES DEPARTMENT. He must thoroughly understand the working of Governors, and be able to advise as to the correct sizes of Pipes required to ensure an adequate supply of Gas in all parts of the Company's District.

The present area of supply is about 28 square miles.

Applications (marked "Superintendent of Mains"), stating age, married or single, previous engagements, and salary required, to be made by letter only, addressed to Sir Fredk. T. Mappin, Bart., M.P., Chairman of the Company, Gas Offices, Sheffield, not later than Friday, Jan. 8, 1892.

Testimonials not to be sent till asked for.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Dec. 18, 1891.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON,

Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 1196 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.

Telegraphic Address: "Braddock, Oldham."

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.

Head Office: MIDDLESBROUGH. Correspondence invited.

SUTTON-IN-ASHFIELD LOCAL BOARD.

THE Gas Committee of this Local Board require the services of a Gentleman to act as CONSULTING ENGINEER.

The duties will be to inspect and report on the condition of the Gas-Works monthly.

The Salary will be £20 per annum (including travelling expenses).

Applications, with testimonials, to be sent in to me on or before Tuesday, the 29th of December.

By order,
G. H. HIBBERT,
Clerk to the Board.

Mansfield,
Dec. 17, 1891.

TAMWORTH GASLIGHT AND COKE COMPANY.

MANAGER REQUIRED.

THE Directors of this Company require at an early date the services of a fully qualified man as MANAGER of the Works. He must possess a thorough practical knowledge of Gas Making in all its branches, and be able to produce a good record as a Carbonizer, Main and Service Layer, the fixing and taking of Meters, making out Accounts, collection of Bills, and keeping the necessary Accounts, and also understand Gas-Engines.

Annual make, about 16 millions.

Salary, £80 per annum, payable monthly; and an allowance of £20 per annum for a House, until and when the Company can provide one.

Applications, enclosing not more than three recent testimonials as to previous experience and ability, to be sent to the CHAIRMAN of the Company, 23, George Street, TAMWORTH.

WANTED, a Cast-Iron Gasholder Tank, about 30 or 40 feet diameter, and 12 to 14 feet deep.

Price, &c., to be sent to W. WINSTANLEY, Gas-Works, Newcastle, STAFFS.

SCRUBBER.

WANTED, a good second-hand Scrubber, from 35 to 40 feet high, about 4 feet diameter, with 8-inch or 10-inch Connections.

State price and particulars, before Jan. 7 next, to JOSEPH SMITH, Clerk, Local Board Offices, SEDGLEY.

CORPORATION OF STRATFORD-UPON-AVON.

THE Gas Committee of the above Corporation invite TENDERS for the supply of FIRE-CLAY RETORTS, BRICKS, &c., required during the ensuing year.

Full particulars and Forms of Tender can be obtained upon application to

J. S. CRANMER,
Manager.

December, 1891.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. OXIDE PAINT, SULPHURIC ACID, & Chemicals. 120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

OXIDE OF IRON. Genuine Natural Bog ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.

D. M. NELSON AND SONS, GLASGOW. Telegraphic Address: "Gas Glasgow." Depôts throughout England and Scotland.

TAR and Liquor wanted.

BROTHERTON AND Co., Commercial Buildings LEEDS.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 1198.

Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

OIL for the "Wells" or "Lucigen" Lamps.

HARDMAN AND Co., Miles Platting, MANCHESTER.

TO CHEMICAL MANUFACTURERS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the purchase of about 350 tons of SPENT OXIDE, now lying at their Gas-Works.

Forms of Tender and Samples may be obtained from the Gas Engineer, Mr. T. O. Paterson, C.E., at the Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Spent Oxide," to be sent in to me not later than Five p.m., on Friday, the 8th of January, 1892.

The Corporation do not bind themselves to accept the highest or any tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
Dec. 23, 1891.

CORPORATION OF LEICESTER.

CAST-IRON PIPE CONTRACT.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply of the necessary CAST-IRON PIPES and CONNECTIONS, from 2 inches to 24 inches in diameter, required during the Twelve months ending the 31st of December, 1892.

Specification and Form of Tender to be obtained from the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Cast-Iron Pipes, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Jan. 2, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M. Inst. C. E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, Dec. 18, 1891.

CORPORATION OF LEICESTER.

RETORTS AND FIRE-BRICKS.

THE Gas Committee of the above Corporation are prepared to receive TENDERS for the supply and delivery of RETORTS and FIRE-BRICKS.

Specification, Quantities, and Form of Tender, can be obtained from the Engineer.

Tenders, addressed to Alderman Lennard, Chairman, and endorsed "Tender for Retorts, &c.," to be delivered at these Offices not later than Eleven o'clock a.m., on Saturday, Jan. 2, 1892.

The Committee do not bind themselves to accept the lowest or any tender.

ALFRED COLSON, M. Inst. C. E.,
Engineer and Manager.

Gas Offices, Millstone Lane,
Leicester, Dec. 18, 1891.

NOW READY. PRICE ONE GUINEA.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS & WATER UNDERTAKINGS.

1879-1890.

Compiled by EDMUND HERBERT STEVENSON, M. Inst. C. E., F. S. I., and EDWARD KYNASTON BURSTAL, M. Inst. C. E., M. Inst. Mech. E.

This Work (which is a continuation of that published in 1879 by the late Mr. G. W. Stevenson) contains information as to the practice of Parliament during the past twelve years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings. The greatest care has been taken in its compilation; and it is arranged in a very handy form.

*** The Work by the late Mr. G. W. Stevenson is still on sale, price One Guinea.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

THE Sandwich Gas Company are prepared to receive TENDERS for the supply of—

One ½-horse power Vertical "OTTO" GAS-ENGINE, with Water-Tank and Fly-Wheel and 9-inch Pulley attached.
One 2000 cubic feet per hour BEALE'S GAS-EXHAUSTER, with 9-inch Pulley attached.
Two 3-inch DISC-FLANGED VALVES.
One 3-inch Self-Acting BYE-PASS FLANGED VALVE.
One 15-inch GAS-GOVERNOR and flanged Throttle-Valve.
8 ft. 2 in. of SHAFTING.
Three 2-inch PLUMMER BLOCKS fitted to Shafting.
Two 15-inch PULLEYS fitted to Shafting.

The above are to be delivered to the Sandwich Railway Station.

Tenders to be sent in, addressed to the Chairman, not later than Jan. 12, 1892.

The Company do not bind themselves to accept the lowest or any tender.

Any further particulars can be had from

JOSEPH LATCHFORD, Manager.

Sandwich, Kent, Dec. 9, 1891.

TO ENGINEERS AND IRONFOUNDERS.

THE Gas Committee of the Stafford Corporation are prepared to receive TENDERS for the Construction and Erection, at their Gas-Works, of Four PURIFIERS, each 20 ft. by 25 ft. by 6 ft. deep, along with Centre-Valve and Connections; also Two HYDRAULIC TRAVELLERS for Lifting Purifier-Covers.

Drawings may be seen and Forms of Tender and Specification obtained, together with any further information, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "New Purifiers, &c.," must be sent to me not later than Twelve Noon on Monday, the 4th of January, 1892.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON, Town Clerk.

Stafford, Dec. 18, 1891.

TO ENGINEERS AND IRONFOUNDERS.

THE Gas Committee of the Stafford Corporation are prepared to receive TENDERS for the Construction and Erection at their Gas-Works of WROUGHT-IRON LATTICE and WARREN GIRDERS, STEEL-ROLLED JOISTS, ROOF PRINCIPALS, CAST-IRON COLUMNS, &c., for New Purifying-Shed.

Drawings may be seen and Forms of Tender and Specifications obtained, together with any further information, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "Ironwork for Purifying-Shed," must be sent to me not later than Twelve Noon on Monday, the 4th of January, 1892.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON, Town Clerk.

Stafford, Dec. 18, 1891.

TO ENGINEERS AND IRONFOUNDERS.

THE Gas Committee of the Stafford Corporation are prepared to receive TENDERS for the Construction and Erection, at their Gas-Works, of STEEL GIRDERS, WROUGHT-IRON PLATES, and CAST-IRON COLUMNS, to form Floor for New Retort-House.

Drawings may be seen and Forms of Tender and Specification obtained, together with any further information, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "Retort-House Floor," must be sent to me not later than Twelve Noon on Monday, the 4th of January, 1892.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON, Town Clerk.

Stafford, Dec. 18, 1891.

THE GASLIGHT AND COKE COMPANY.

NOTICE is hereby given, that the TRANSFER BOOKS of this Company so far as they relate to the Company's Capital Stocks WILL BE CLOSED on the Evening of Tuesday, the 5th day of January next, and be re-opened immediately after the Half-Yearly Meeting of the Company, to be held in the month of February next.

By order,
JOHN ORWELL PHILLIPS, Secretary and General Manager.

Chief Office: Horseferry Road, Westminster, S.W., Dec. 24, 1891.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO CONTRACTORS, BUILDERS, AND OTHERS.

THE Gas Committee are prepared to receive TENDERS for excavating and building the FOUNDATIONS of a proposed extension of the RETORT-HOUSE at their Portwood Gas-Works.

Quantities may be obtained, and Drawings and Specifications seen, on application to the Gas Engineer, Mr. S. Meunier, Millgate Gas-Works, Stockport.

Intending Contractors to deposit the sum of £2, which will be returned on receipt of a *bond fide* tender.

No form of tender but that supplied by the Committee will be entertained.

Tenders, endorsed "Tender for Retort-House Extensions, &c.," to be addressed to the Chairman of the Gas Committee on or before Jan. 7 next ensuing.

The Committee do not pledge themselves to accept the lowest or any tender.

By order,
WALTER HYDE, Town Clerk.

Stockport, Dec. 24, 1891.

CIRENCESTER GAS COMPANY, LIMITED.

SALE OF 300 SHARES.

THE Directors of the Cirencester Gas Company, Limited, give notice that 300 £15 NEW ORDINARY SHARES, bearing a maximum Dividend of 7 per cent., of and in the Cirencester Gas Company, Limited, being a portion of the additional Capital authorized to be raised under the provisions of the Cirencester Gas Order, 1891, will be offered FOR SALE by auction by Messrs. Moore and Hill, at the King's Head Hotel, Cirencester, on Monday, the 18th day of January, 1892, at Four o'clock in the afternoon precisely, in lots of Five each, and will be issued to each purchaser as paid-up Shares after full payment of the purchase-money.

Further particulars and Conditions of Sale may be obtained from the Auctioneers, Corn Hall Buildings, Cirencester; Messrs. Mullings, Ellett, and Co., Solicitors, Cirencester; or of

J. P. BEECHAM, Secretary.

12, Silver Street, Cirencester, Dec. 23, 1891.

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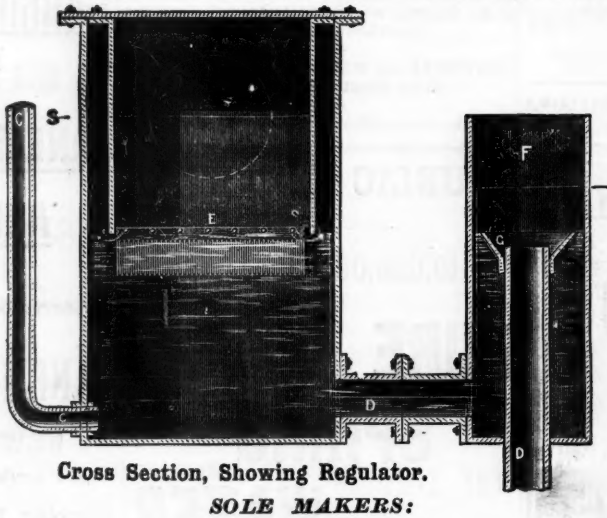

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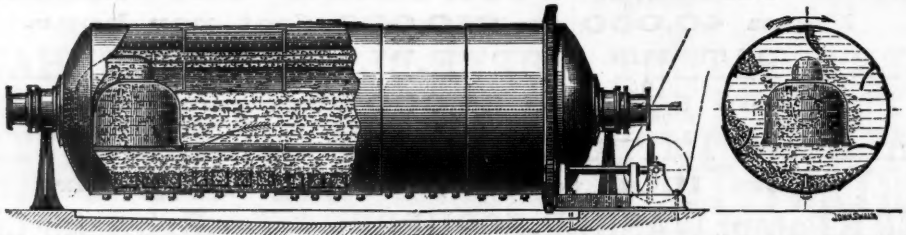

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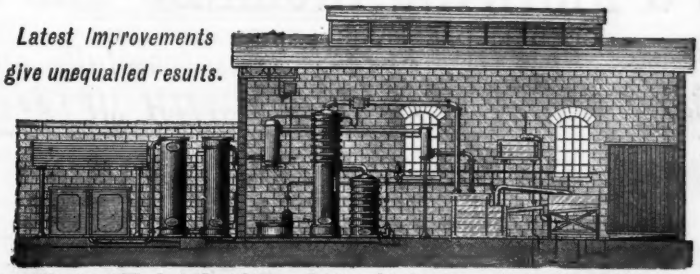

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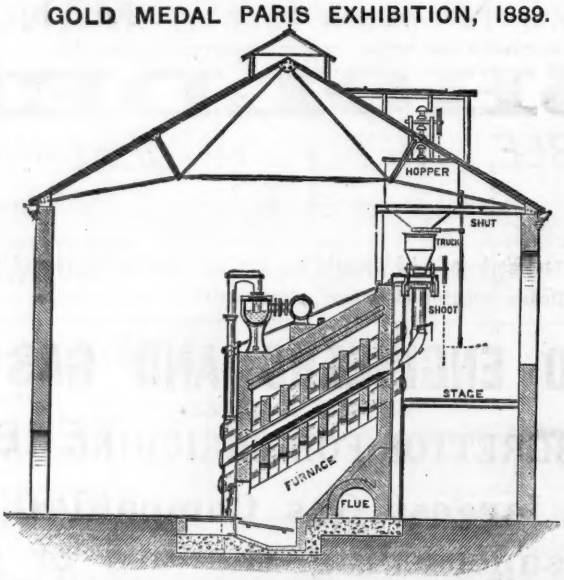

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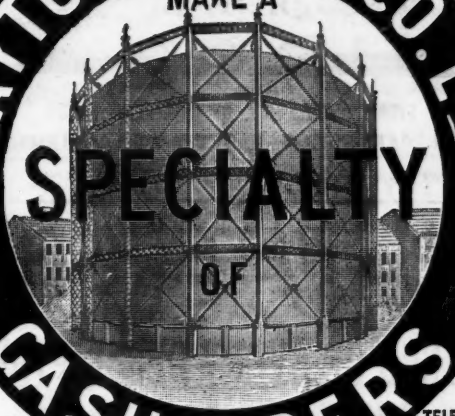

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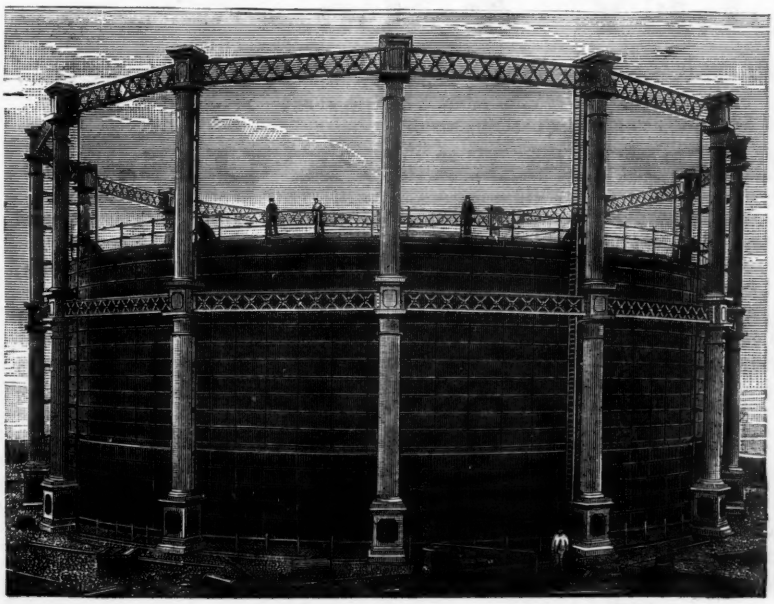

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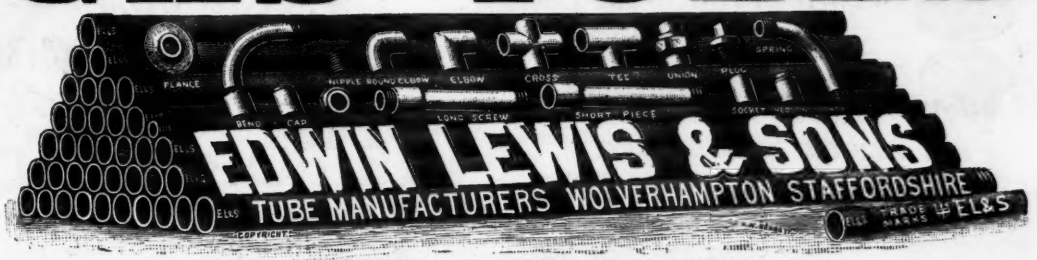

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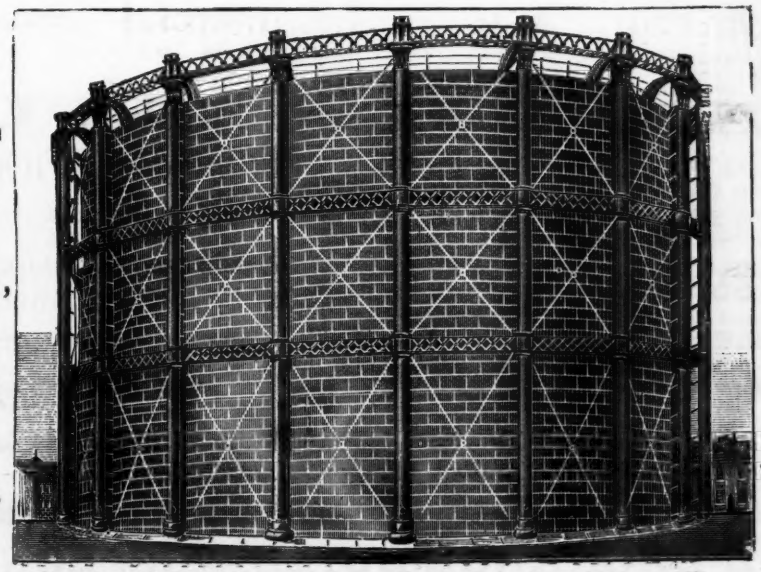

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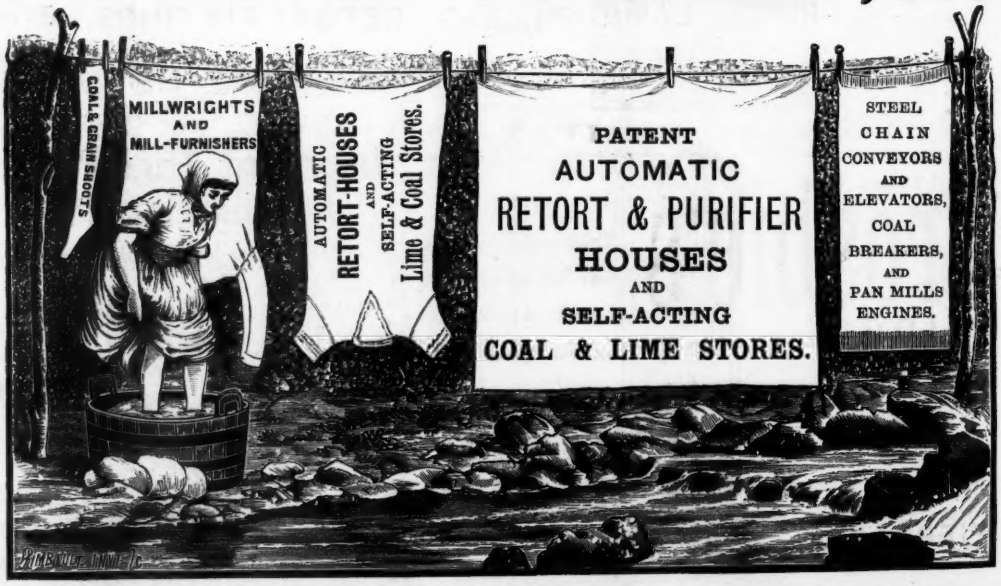
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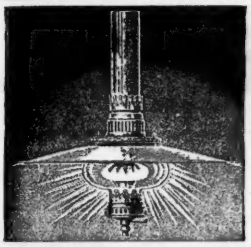

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The attention of Gas Engineers is particularly called to this Lamp as being the **cheapest, most simple, durable, and adaptable Lamp in the market.**
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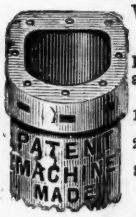

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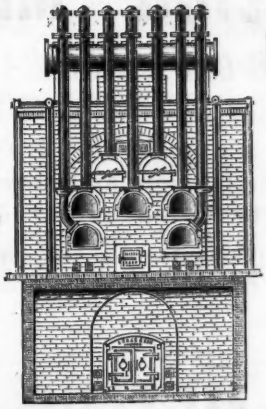

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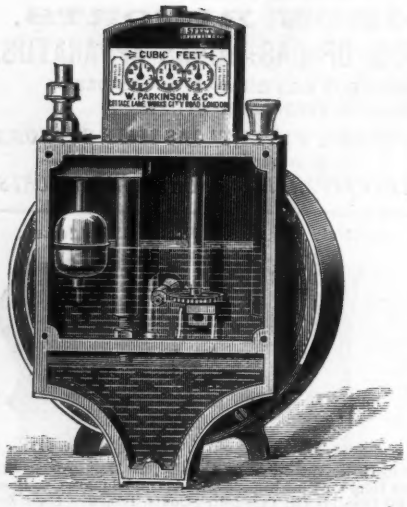

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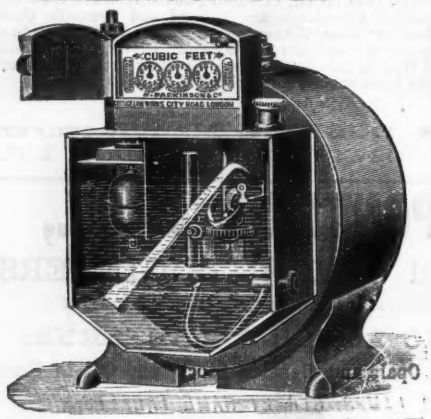
Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.



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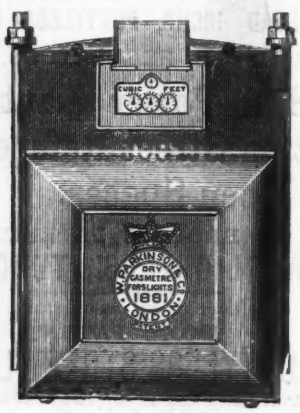

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These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

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(See also Advt. p., 1170.

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